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FORMERLY

AMERICAN VETERINARY REVIEW

(Original Official Organ U. S. Vet. Med. Ass'n.)

EDITED AND PUBLISHED FOR

The American Veterinary Medical Association

POULTRY DISEASE NUMBER

CONTENTS

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H. Preston Hoskins, Secretary-Editor, 716 Book Building, Detroit, Mich.

Vol. LXX, N. S. Vol. 23 **February, 1927** **No. 5**

ANOTHER POULTRY NUMBER

It is exceedingly gratifying to note how veterinarians are taking hold of poultry diseases. That they are doing so is evidenced in a number of ways. For example, take this issue of the Journal, t he third to be devoted exclusively to diseases of poultry within a period of less than two years. The first time this was attempted was in May, 1925. The effort was received so favorably that plans were made for another poultry number, which made its appearance just one year ago, February, 1926. The best evidence of the value attached to this particular number is in the fact that our reserve supply was exhausted soon after publication and even though we have been advertising to buy back copies of this number ever since, we can not get enough copies to supply orders on hand, let alone replenish our reserve stock for future demands.

The fact that we have been able to assemble papers sufficient for three issues of the Journal, almost all of which were prepared by veterinarians, is in itself concrete evidence of the interest in poultry diseases being shown by members of our profession. These papers may be divided into two classes: those which have been read before veterinary meetings prior to their publication in the Journal, and those which have not. In the latter class

are found mostly those papers reporting the results of original research work. On the other hand, the number of papers published as having been read before meetings of the A. V. M. A. and other associations is evidence of the attention which is being given to poultry diseases by those to whom falls the duty of arranging the programs for these meetings.

It is rather the exception than the rule to pick up a program of a veterinary meeting nowadays, and not find at least one paper or address on some poultry disease. Usually there are several. A number of veterinarians have already earned reputations as poultry pathologists and these men are kept busy accepting invitations to appear on programs in all parts of the country, to pass on to other veterinarians some of the knowledge gained by their investigations in this special field.

Then, too, we want to give a full measure of credit to the men in private practice who have done everything possible to get posted right up to the minute on poultry diseases. Many veterinarians have grasped every opportunity presented to them for improving and supplementing their knowledge of poultry diseases. At the time that most present-day practitioners went through college little or no attention was given to poultry. As a consequence these men must spend additional time and money in pursuing postgraduate work, attending short courses and conferences, reading new text-books, bulletins, journals, and even sanitary control regulations, to acquire this knowledge and keep abreast of the wonderful progress that is being made by their colleagues in the laboratory.

And now, what does all this mean? Who is going to benefit in the end? Without any question the great poultry industry of this country is going to be the greatest beneficiary. Every person who has a dollar invested in poultry is going to have that investment made more secure by having available, at an instant's notice, a body of men prepared to handle any emergency that confronts the health and well-being of our poultry industry. As we have stated on a previous occasion, the veterinary profession has never been found wanting when called upon in an emergency. As far as poultry diseases are concerned, this was amply demonstrated about two years ago, when fowl pest found its way into this country. Even though considerably hampered by the obstructionist tactics of a number of self-appointed experts, with little or no professional training, just as soon as the proper authorities recognized the fact that a serious situation confronted

the poultry industry and turned a purely animal-disease-control problem over to veterinary sanitarians, real progress was made toward eradicating fowl pest. The complete freedom of this country from this disease for over a year is the best possible evidence of the thoroughness and efficiency with which the job was done.

Let the shoemaker stick to his last.

OUR HORSE-DRAWN ARMY

In a recent issue of *The Chicago Tribune* was an editorial of considerable length, taking the War Department to task for not dispensing with horse-drawn transportation. It was ironically entitled "Our Horse-Drawn Army," and implied throughout that, at this day and age, anything that desires to move should motorize. As experts agree that there is national danger in molding ideas to that effect in the minds of the rising generation, we are pleased that Ex-President Merillat, who is qualified to speak on the subject from first-hand experience, as former Chief Veterinarian, 1st Army, A. E. F., was prompted to reply as follows:

As much as it would be desirable to eliminate animals from the tables of organization of the Army, as your editorial "Our Horse-Drawn Army" suggests, it is unfortunate that such a radical change might prove disastrous to our military efficiency, if the lessons we learned in France during 1918 are worth anything at all. Having been in close touch with the entire animal situation during the major operations of that year, I am prompted to state, at the risk of appearing rude, that the writer of that editorial does not know what he is talking about; and were it not that ideas expressed by a paper as influential as *The Chicago Tribune* may mold into reality, no real harm could accrue from such wild guesswork.

All agree that it would be a welcome reform if animals in war could in some way be replaced by inanimate motor power, especially now that so few men know the limit of their endurance and the care they require. But facts can not be so easily set aside. The truth is that an army without animals becomes a helpless, suffering mob, if the experience we had is a criterion.

The breaking down of transportation in October, 1918, was not due to the shortcomings of horses and mules, but to a shortage of them when the motor transportation left the First Army practically paralyzed. Although we had thousands of horses and mules available at home, there were no replacements in France and as a consequence the remount and veterinary services combined their efforts to keep the few animals we had in action, instead of evacuating and replacing them according to prearranged plans.

Moreover, the impression conveyed by the editorial in question is all wrong. The writer would have an army speedy at all hazards when in fact the certainty of movement and not speed is the desideratum. Nothing is more snail-like than an army moving forward, and as it crowds slowly on, the terrain, including the best of roads, may become impassable to everything except men on foot and animals. Then, there are woods, thickets, wide areas of deep, loose soil, and great seas of mud to consider seriously before passing snap judgment on the matter of army transportation. If the writer of the editorial was engaged in the unpleasantry we had abroad in 1918, he must have entirely forgotten the matter of terrain. With all our dirt roads, lightly graveled roads, narrow, one-way roads, muck and sandy soil, hills, rains, snow, and ice, it

would be nothing less than a national catastrophe to mobilize a large military force and trust solely to motor transportation. No matter what advantages horseless transportation appears to hold out to the uninformed, the general staff may be trusted to settle the question on its merits, provided it is not compelled to yield to ill-conceived public opinion.

BRIGHT SPOTS

Secretary Steel, of the Iowa Veterinary Association, reports an attendance of over 400 at the recent meeting in Des Moines, with over 500 in attendance at the banquet. The collection of dues at the meeting exceeded $1,000.

Secretary Boyd, of the Indiana Veterinary Medical Association, reports fifty-two new members, including several reinstatements, at the annual meeting recently held in Indianapolis.

Dr. F. J. Muecke, A. V. M. A. resident secretary for Indiana, secured thirteen applications for membership in the A. V. M. A. and one application for reinstatement, during the meeting.

Secretary Fitch, of the Minnesota State Veterinary Medical Association, writes that the attendance figure reached 248 at the annual meeting held in Minneapolis, January 13-14.

During the five months, October, 1925, February, 1926, there were forty-eight applications for membership listed in the JOURNAL. Figures for the corresponding period one year later, namely, October, 1926, February, 1927, show a total of fifty-nine applications listed, a gain of eleven over one year ago.

During the past ten days, we have been sending out the second notices for dues. This year it was necessary to send fewer notices for this purpose than during any year recently. At the rate the dues are coming in, over two-thirds of our members will be in possession of their 1927 membership cards by the end of January.

APPLICATIONS FOR MEMBERSHIP

(See October, 1926, JOURNAL)

FIRST LISTING

ANDERSON, ERMA D. Mentone, Ind.
D. V. M., McKillip Veterinary College, 1904
Vouchers: F. J. Muecke and T. A. Sigler.

BIXLER, ALBERT E. Rawson, Ohio
D. V. M., Ohio State University, 1916
Vouchers: Leonard W. Goss and O. V. Brumley.

CLARK, SAMUEL WEIR 2420 4th Ave., Seattle, Wash.
D. V. M., Chicago Veterinary College, 1912
Vouchers: E. A. Ehmer and R. A. Button.

DANNER, HOWARD 1725 So. Meridian St., Indianapolis, Ind.
D. V. M., Indiana Veterinary College, 1906
Vouchers: F. J. Muecke and T. A. Sigler.

ELROD, ROY W. Pekin, Ind.
D. V. M., Indiana Veterinary College, 1910
Vouchers: F. J. Muecke and T. A. Sigler.

FISH, LYNUEL O. Norman Station, Ind.
D. V. M., Indiana Veterinary College, 1916
Vouchers: F. J. Muecke and T. A. Sigler.

GIBBONS, RICHARD V. 203 Auburn St., Ithaca, N. Y.
D. V. M., Cornell University, 1925
Vouchers: D. H. Udall and M. G. Fincher.

HARRISON, JOSEPH RAYMOND 427 No. Plum St., Union City, Ind.
V. S., Ontario Veterinary College, 1908
Vouchers: F. J. Muecke and T. A. Sigler.

HARSHFIELD, GERALD SMITH East Liberty, Ohio
D. V. M., Ohio State University, 1926
Vouchers: C. S. Elliott and Leonard W. Goss.

HAVERFIELD, ALFRED O. 931 Market St., Wheeling, W. Va.
D. V. M., Ohio State University, 1926
Vouchers: A. C. Dunlap, Leonard W. Goss and S. E. Hershey.

HIGGINS, EARL Bluffton, Ind.
D. V. M., Indiana Veterinary College, 1917
Vouchers: R. H. Boyd, T. A. Sigler and F. J. Muecke.

KRONE, CHARLES B. Auburn, Nebr.
D. V. M., Kansas State Agricultural College, 1926
Vouchers: Fred R. Allerton, Carl J. Norden and F. Perrin.

LEE, ALVIN LEONARD Howard Lake, Minn.
D. V. M., Kansas City Veterinary College, 1916
Vouchers: H. C. H. Kernkamp and E. A. Hewitt.

MCCONNELL, ELZA C. Cynthiana, Ind.
D. V. M., Indiana Veterinary College, 1910
Vouchers: F. J. Muecke and T. A. Sigler.

MAGNO, GRACIANO G. Pozorrubio, Pangasinan, P. I.
D. V. M., University of Philippines, 1923
Vouchers: G. San Agustin and A. K. Gomez.

MEANS, TRUMAN I. Box 1174, Sante Fe, N. Mex.
D. V. M., Colorado Agricultural College, 1920
Vouchers: Frank H. Barr and Sam W. Wiest.

MOHR, EARL S. Connersville, Ind.
D. V. M., Indiana Veterinary College, 1914
Vouchers: F. J. Muecke and T. A. Sigler.

MOORE, RAYMOND A. 202 Avery St., Frankfort, Ind.
D. V. M., Indiana Veterinary College, 1917
Vouchers: F. J. Muecke and R. H. Boyd.

NELSON, ONDIA ASHLEY Box 122, Advance, Ind.
V. M. D., Indiana Veterinary College, 1902
Vouchers: T. A. Sigler and F. J. Muecke.

PETERMAN, J. E. 320 Agriculture Bldg., Raleigh, N. C.
D. V. M., St. Joseph Veterinary College, 1916
Vouchers: W. C. Dendinger and N. B. Tyler.

PETERS, LEE ROY Redkey, Ind.
D. V. M., Indiana Veterinary College, 1912
Vouchers: F. J. Muecke and T. A. Sigler.

PROTHERO, H. B. 217 Messenger St., Johnstown, Pa.
V. M. D., University of Pennsylvania, 1920
Vouchers: G. A. Dick and C. J. Marshall.

SANTA MARIA, RAFAEL F. 2800 13th St. N. W., Washington, D. C.
V. M. D., University of Havana, 1910
Vouchers: Wm. P. Hill and F. H. K. Reynolds.

SCHMIDT, LEONARD HENRY New Bremen, Ohio
D. V. M., Ohio State University, 1925
Vouchers: Leonard W. Goss and O. V. Brumley.

SHARTLE, CLARENCE F. Stilesville, Ind.
V. M. D., Indiana Veterinary College, 1907
Vouchers: G. M. Wagaman, T. A. Sigler.

SULLIVAN, LATEN R. 320 Agriculture Bldg., Raleigh, N. C.
D. V. M., Alabama Polytechnic Institute, 1923
Vouchers: W. C. Dendinger and N. B. Tyler.

THORP, FRANK JR. Va. Polytechnic Institute, Blacksburg, Va.
D. V. M., Iowa State College, 1926
Vouchers: I. D. Wilson and Russell A. Runnells.

WARD, WARREN J. 2406 Prairieton Ave., Terre Haute, Ind.
D. V. M., Indiana Veterinary College, 1921
Vouchers: F. J. Muecke and T. A. Sigler.

Applications Pending

SECOND LISTING

Burington, Irvin O., Marie Apts., South St. Paul, Minn.
Conlin, William Jerome, 608 Lincoln Ave., Apt. 105-C, St. Paul, Minn.
Gooding, Cloyde Lee, 509 Grand Ave., So. San Francisco, Calif.
Hatfield, George Raiford, Monroe, Ga.
Kinney, William Graham, 2420 4th Ave., Seattle, Wash.
Simmons, George M., 2500 16th St., San Francisco, Calif.
Stout, Frank, Mendon, Ill.
Swenson, Lloyd Alexander, Sherburn, Minn.
Whitmore, William Wesley, 6204 So. Park Ave., Chicago, Ill.
Young, Guy F., Marshall, Minn.

Reinstated

REINSTATED

Fisher, Charles W., 840 E. Jackson St., Martinsville, Ind.

The amount that should accompany an application filed this month is $9.58, which covers membership fee and dues to January 1, 1928, including subscription to the JOURNAL.

COMING VETERINARY MEETINGS

Wisconsin Veterinary Medical Association. Madison, Wis. Feb. 1-2-3, 1927. Dr. O. H. Eliason, Secretary, 226 W. Gilman St., Madison, Wis.

Alabama Veterinary Medical Association and Short Course for Practitioners. Auburn, Ala. Jan. 31-Feb. 1-2-3-4-5, 1927. Dr. C. A. Cary, Secretary, Auburn, Ala.

Connecticut Veterinary Medical Association. Hartford, Conn. Feb. 2, 1927. Dr. Geo. E. Corwin, Secretary, 11 Warrenton Ave., Hartford, Conn.

New York City, Veterinary Medical Association of. Academy of Medicine, 17 W. 43rd St., New York, N. Y. Feb. 2, 1927. Dr. C. P. Zepp, Secretary, 128 W. 53rd St., New York, N. Y.

San Diego-Imperial Veterinary Medical Association. San Diego, Calif. Feb. 2, 1927. Dr. W. G. Oliver, Secretary, 3821 Arizona St., San Diego, Calif.

Chicago Veterinary Society. Great Northern Hotel, Chicago, Ill. Feb. 8, 1927. Dr. J. B. Jaffray, Secretary, 2956 Washington Blvd., Chicago, Ill.

Ontario Veterinary Association. Prince George Hotel, Toronto, Ont. Feb. 9, 1927. Dr. H. M. LeGard, Secretary, 223 Main St. No., Weston, Ont.

Southeastern Michigan Veterinary Medical Association. Detroit, Mich. Feb. 9, 1927. Dr. H. Preston Hoskins, Secretary, 716 Book Bldg., Detroit, Mich.

Kansas State Agricultural College Conference for Veterinarians. Manhattan, Kans. Feb. 9-10, 1927. Dr. R. R. Dykstra, Dean, Kansas State Agricultural College, Manhattan, Kans.

Manitoba, Veterinary Association of. Royal Alexandra Hotel, Winnipeg, Man. Feb. 11, 1927. Dr. Wm. Hilton, Secretary, 510 Greenwood Place, Winnipeg, Man.

Kansas City Association of Veterinarians. New Baltimore Hotel, Kansas City, Mo. Feb. 15, 1927. Dr. J. D. Ray, Secretary, 400 New Centre Bldg., Kansas City, Mo.

Illinois Veterinary Conference, University of. Urbana, Ill. Feb. 15-16, 1927. Dr. Robert Graham, University of Illinois, Urbana, Ill.

Florida State Veterinary Medical Association. Gainesville, Fla. Feb. 21-22, 1927. Dr. A. L. Shealy, Secretary, University of Florida, Gainesville, Fla.

Massachusetts Veterinary Association. 20th Century Club, 3 Joy St., Boston, Mass. Feb. 23, 1927. Dr. H. W. Jakeman, Secretary, 44 Bromfield St., Boston, Mass.

Northwestern Ohio Veterinary Medical Association. Commodore Perry Hotel, Toledo, Ohio. Feb. 23, 1927. Dr. F. A. Lambert, Secretary, c/o Columbus Serum Co., Sta. C, Box 53, Columbus, Ohio.

Keystone Veterinary Medical Association. Philadelphia, Pa. Feb. 23, 1927. Dr. C. S. Rockwell, Secretary, 5128 Chestnut St., Philadelphia, Pa.

Ohio State University Conference of Veterinarians. Columbus, Ohio. Mar. 23-24-25, 1927. Dr. D. S. White, Dean, Ohio State University, Columbus, Ohio.

TWO BASIC FACTORS IN COCCIDIAL INFECTION OF THE CHICKEN*

By W. T. JOHNSON,

Oregon Agricultural Experiment Station,† Corvallis, Oregon

Factors of basic importance from the standpoint of coccidiosis control are: the relationship of the number of sporulated oöcysts ingested to the severity of the disease, and elimination of the parasite (*Eimeria avium*) in the fecal discharges. The severity of coccidial infection can be controlled with a high degree of regularity when experimental inoculation is resorted to. Ingestion of small numbers of sporulated oöcysts by susceptible experiment fowls has resulted in no symptoms being shown, while ingestion of large numbers has resulted in death. Duration of the infection is limited. Most infected fowls rid themselves of coccidial forms in a comparatively short time.

These points were brought out in previous papers[1,2] following observations on a small number of fowls artificially inoculated and large numbers infected naturally. A paper by Beach and Corl,[3] containing the statement, "There was no correlation between the time or amount of mortality and the size of the dose of sporulated oöcysts or the age of the chicks," seemed to question the present writer's statement regarding the effect of doses of various sizes. Fowls were further inoculated, therefore, in an effort to establish definitely the effect produced by small and large numbers of sporulated oöcysts. In conducting investigations regarding this problem it was found possible to combine this with further determinations as to rate of elimination of *Eimeria avium* from infected fowls.

Were it not true that the number of sporulated oöcysts ingested bears a vital relationship to the development of coccidiosis, the most important part of our control measures recommended at the present time would be without much foundation. If there is no difference in effect produced by "one oöcyst or fifty thousand," then there would not seem to be much reason for advising thorough and frequent cleaning as a means of controlling this disease. It is doubtful if cleaning in connection with commercial poultry-rearing establishments, in operation for some time, ever

*Presented at the sixty-third annual meeting of the American Veterinary Medical Association, Lexington, Kentucky, August 17-20, 1926.

†Investigations conducted in part at Western Washington Experiment Station of the State College of Washington, Puyallup, Washington. Resigned August 1, 1925.

entirely eliminates coccidial oöcysts from all places to which the fowls have access. Experimental production of coccidiosis as reported in the following pages should justify the application of sanitary measures which reduce the degree of contamination. Future methods of control, involving actual production of coccidiosis, which at the present writing are under investigation at the Oregon Experiment Station, are primarily dependent upon the knowledge that the degree of coccidiosis development bears a distinct relationship to the number of sporulated oöcysts ingested.

White Leghorns were used in all cases. They were taken from flocks raised in the usual manner, as well as under controlled conditions, so far as intestinal parasites were concerned. The fowls were placed in cages either before or at the time of inoculation, the cages being provided with hardware-cloth bottoms of three-quarter-inch or one-half-inch mesh. This size mesh quite readily permitted the droppings to pass through and what did not, dried soon after being expelled, thus preventing sporulation of coccidial oöcysts and re-inoculation. By placing one fowl in a cage at a time it was possible to examine the droppings from each separately for determinations as to infection. The fowls of each group being compared were fed the same ration.

It was rare to find even a trace of coccidial infection in the fowls raised indoors with the idea of preventing intestinal infection. In no case did coccidial mortality occur in connection with this work when the fowls were being raised with the object specifically in mind of raising them free.

The cultures used were prepared by taking cecal contents or droppings from infected fowls to the amount of about 0.15 gram of fresh droppings for each culture. Only cecal contents containing many oöcysts were used. This material was placed in specimen vials 25 mm. in diameter and 80 mm. in height and mixed with 2.5 per cent potassium bichromate in distilled water. The vials were stoppered with corks to lessen evaporation and placed at room temperature until diluted for use. In all cases the dilutions for inoculations were made by the addition of tap water. Adding potassium bichromate prevents putrefaction very well without apparently being detrimental to the oöcyst. In order to obtain the least putrefaction and the greatest sporulation it is advisable to use only a small amount of oöcyst-containing material and just enough potassium bichromate solution to give a slight amount of free moisture. If one desires to sporulate very large numbers of oöcysts, petri dishes can be used satisfactorily. If the

culture material is kept in the petri dishes for some time, frequent additions of moisture are necessary, which is only occasionally necessary when stoppered vials are used. If petri dishes are used when sporulating, the oöcysts are washed off, after several days, with tap water and placed in stoppered vials and kept in a refrigerator maintaining a temperature of about 7° C. After sporulation the oöcysts may be mixed with considerable quantities of water and kept for a period of months without any apparent loss in pathogenicity.

The possibility of using potassium bichromate for coccidial sporulation in connection with inoculation work suggested itself to the writer, following information from Dr. Philip B. Hadley,* formerly of the Rhode Island Experiment Station, that this could be used for preserving coccidial oöcysts for future study.

The advisability of using something to prevent putrefaction when sporulating oöcysts in fowl feces is very apparent. Cultures prepared by adding distilled or tap water to intestinal content or droppings quickly undergo putrefaction at room temperature with delayed sporulation or complete prevention of sporulation. If this condition persists death of the oöcyst results.

Sporulation can be brought about by the use of water, if certain precautions are taken. Putrefaction can not be so readily controlled with these conditions as with potassium bichromate solution. An illustration of sporulation by the use of ordinary moisture was demonstrated by a petri-dish culture, prepared July 3, 1926. The preparation of this culture involved placing a layer of cotton in a petri dish and adding tap water to the point of saturation. A piece of absorbent paper was placed over this. Moisture was readily taken up from the cotton beneath. Cecal content from one fowl was then smeared in a thin layer over the paper. A large percentage of the contracted content oöcysts showed normal sporulation by July 5. July 10, the coccidial material was scraped off, placed in a vial and diluted with about twenty cubic centimeters of tap water. Part of this suspension was used for inoculations July 10. The remainder not used on this date was placed in the refrigerator until used the next day.

That cultures prepared without preservative, such as potassium bichromate, may not be satisfactory was demonstrated by the culture described above, prepared on July 3. This suspension was used on July 10 to infect eight chicks hatched June 7, 1926. Two were given part of the above suspension containing approxi-

*Personal communication.

mately 5,000 sporulated oöcysts; two, 50,000; two, 75,000; and the last two, 150,000. Autopsies July 17 and 18 revealed that all were infected and that the two fowls given the 5,000 oöcysts were apparently slightly less severely infected. There was no well-defined distinction shown as to severity of infection between the low-dose and heavy-dose fowls.

July 11, some of the suspension remaining after the inoculations July 10 was given to four susceptible chicks, hatched June 7 and raised with those inoculated July 10. Two were given approximately 5,000 each and the other two, 250,000 each, the oöcysts appearing normal at this time. The suspension was almost completely non-pathogenic, as evidenced by autopsy of two of the fowls on July 19, and by none of the four having shown any symptoms. The fowls autopsied included one given 5,000 and one given 250,000 oöcysts. With the addition of potassium bichromate to the cultures before sporulation, such an occurrence would not be likely to take place. The addition of this chemical, therefore, is of distinct value in determining the effect of variation in the number of oöcysts ingested, by eliminating such secondary factors as putrefaction. No doubt the multitudinous situations in nature afford parallel conditions. Mixing fecal material containing oöcysts sporulated in potassium bichromate with tap water, and keeping this suspension in the refrigerator for future inoculation is a practice commonly employed at this laboratory.

It appears that the rate of sporulation of *Eimeria avium* is the same in 2.5 per cent potassium bichromate as it is when kept moist with tap water. Whis was shown by cultures prepared in two petri dishes, July 17, 1926. One petri dish contained four pieces of cotton, two saturated with distilled water and two with 2.5 per cent potassium bichromate solution in distilled water. The other contained one of each type of moisture. A piece of absorbent paper was placed over each piece of cotton and intestinal content containing coccidial oöcysts was smeared over this. Microscopic examination was made to determine sporulation at twenty-four and forty-eight hours after preparation. There was no significant difference in rate of sporulation between the water and potassium bichromate cultures.

Eighteen-millimeter cover-glasses were used in preparing all smears and each smear made thin enough to insure ready observation under the micriscope. Observations were made with a microscope equipped with 4-millimeter and 16-millimeter objectives

TABLE I—*Data on group 1*

FOWL NO. AND SEX			A-1 CKL.	A-2 CKL.	A-3 CKL.	A-4 CKL.	A-5 PUL.	A-6 PUL.	A-7 PUL.
Inoculation		Date Amt. (cc)	4/22 10.0	4/22–27 1.0	4/22–27 1.0	None	4/22 10.0	4/22–27 1.0	4/22–27 1.0
Droppings		Macro. Micro.	4/27 S.B. 4 Me.	4/27 S.B. 2 Me.	4/27 S.B. 23 Me.	4/27 N. 0	4/27 M.B. M. Me.	4/27 N.B. 0	4/28 M.B. M.Me. 10.
Autopsy		Died Killed	6/2	4/28	4/29	6/4	4/28	4/28	6/4
Cecal Content	Cecum 1	Macro. Micro.	N. 3x Neg.	E.B. 0	M.B. 0	N. 3x Neg.	E.B. 0	E.B. 0	N. 3x Neg.
	Cecum 2	Macro. Micro.	N. 4x Neg.	Blood* 0	M.B. N.Me. M.O.	N. 3x Neg.	E.B. N.Me.	E.B. N.Me.	N. 3x Neg.
Duodenum		Micro.	3x Neg.	0	0	3x Neg.	2x Neg.	2x 2 Me.?	3x Neg.

*Pure blood and caseous core.

and 10X or 12.5X eye-pieces. In connection with examination of cecal smears, various parts of the cecal content were taken so as to obtain as representative a sample as possible. The duodenal smears were made from scrapings about four inches from the gizzard. As a rule a definite part of the smear was examined and a record kept as to the amount of the smear so examined and this was designated by 1x, 2x, etc., as the case might be, the number referring to the times across the cover-glass with the 4-millimeter objective. In some instances various parts of a smear were examined without crossing the entire preparation and in such cases it was obviously impossible to determine the area covered. The date of macroscopic examination of the droppings denotes the date of the microscopic examination unless otherwise specified.

Counts were not made as to the number of sporulated oöcysts nor quantities of suspension measured. This was not regarded as essential to a solution of the problem at hand and circumstances made it difficult to make such determinations with regularity. The figures given as to these points represent estimates.

Group I

April 22, 1925, seven White Leghorn chicks, hatched March 12, 1925, were placed in wire-bottom cages. These chicks had been kept indoors under conditions unfavorable to coccidiosis development from the time of hatching.

On the above date six of the chicks were inoculated by using cultures from four sources; three being inoculated with material from the same source. These chicks were infected with the idea of obtaining information as to the minimum lethal dose and at the same time determining the pathogenicity of each culture, as a part of other investigations. Each chick was given material from a different culture. The culture given to A-1 was prepared April 7, 1925. A-5 was infected with a culture comparable in all respects to that given A-1 and comparable to that given A-7, except that the ones for A-1 and A-5 were sporulated out-of-doors in the sun and the other in the laboratory out of the direct rays of the sun. The cultures used for A-2, A-3 and A-6 were prepared March 16, April 8 and March 4, 1925, respectively, and all were prepared in a similar manner and kept at room temperature away from direct sunlight. A-1 and A-5 were given each an entire culture (approximately 0.15 gram coccidial material) at one dose, while in the other cases the dose on this date was

TABLE II—*Data on group 2*

FOWL NO. AND SEX			A-8 CKL.	A-9 CKL.	A-10 CKL.	A-11 CKL.	A-12 PUL.	A-13 PUL.	A-14 PUL.
Inoculation		Date Amt. (cc)	5/6–8 12.0	None	5/6–8 0.1	5/6–8 12.0	5/6–8 0.1	5/6–8 0.1	5/6–8 12.0
Droppings		Macro. Micro.	5/13 V.B. 15 Me.	5/13 N.B. 0	5/13 M.B. M.Me. 2–0	5/11 V.B. N.Me.	5/13 M.B. M.Me. 3–0	5/13 S.B. 5 Me. 27–0	5/11 M.B. 5 Me.
Autopsy		Died Killed	5/13	6/5	6/5	5/12	6/4	6/4	5/12
Cecal Content	Cecum 1	Macro. Micro.	E.B. 0	N. 3x Neg.	N. 3x Neg.	E.B. 0	N. 3x Neg.	N. 3x Neg.	E.B. 0
	Cecum 2	Macro. Micro.	E.B. 0	N. 3x Neg.	N. 3x Neg.	E.B. 0	N. 3x Neg.	N. 3x Neg.	E.B. 0
Duodenum		Micro.	0	3x Neg.	3x Neg.	0	3x Neg.	3x Neg.	0

about one-fiftieth of a culture and about the same amount on each on five consecutive days.

A study of table I shows that there was no significant difference in the results between those receiving the large dose and those the smaller dose. It is not improbable, judging from the time of death, that the small-dose fowl which died did so as a result of the first inoculation, which represents about one-fiftieth of the amount received by those being given the larger dose.

Coccidial forms were found in connection with all the fowls, either in the droppings or at autopsy, except in the case of the check fowl, which evidently remained free. A-1 and A-7, which survived the attack, were autopsied forty-one and forty-three days, respectively, after the first inoculations and no coccidial forms were found in the duodenum or ceca, evidently all having passed out in the droppings. Microscopic examination of the droppings from these two fowls, April 27 and 28, or five and six days, respectively, after the first inoculation, definitely established that infection had taken place.

Group 2

May 5, 1925, six chicks, hatched March 12, 1925, with those reported in group 1 and kept with them to April 22, were inoculated. There were seven chicks in this group but one was used as a check and not inoculated. The four remaining cultures used in connection with group 1 were kept in a household refrigerator and three were used to inoculate the chicks in group 2. The cultures were kept in the refrigerator to prevent putrefaction.

Each of three cultures furnished coccidial oöcysts for inoculating two fowls—one being given what was termed a "large dose" and the other a "small dose," May 5 to May 8, 1925, inclusive. In this manner each pair of large- and small-dose fowls were directly comparable in so far as the source of the inoculating suspension, feeding, breeding, date of hatching, and rearing were concerned. Inoculation took place three days in succession, the heavy-dose fowls receiving gradually increasing doses in the following ratio: 1:2:3, and the small dose fowls a uniform dose each day. The cultures given had been diluted since first used for inoculation, April 22, 1925.

The results reported in table II show that all the fowls developed coccidial infection. Those receiving the larger dose all died of coccidiosis, while all the small-dose fowls lived. The small-dose fowls showed no distinct droopiness, although they did not appear active for a time.

Autopsy of the check as well as the small-dose fowls, twenty-nine and thirty days, respectively, after the first inoculation, revealed no coccidial forms, which indicated that these fowls were entirely free of the parasite.

Group 3

This group consisted of three fowls, hatched April 16, 1926, and kept indoors with a few others of the same hatch and raised under laboratory conditions, so as to eliminate coccidial infection or reduce it to a minimum.

The infective material used in this case was from one of the cultures given to groups 1 and 2 to inoculate fowls A-2, A-8 and A-12. This culture had been kept in a household refrigerator since dilution April 22 and was diluted further, May 6 and May 18. All three fowls were inoculated three times, May 18, 19 and 21, A-15 receiving a total of six cubic centimeters and A-16

Table III—*Data on group 3*

Fowl No. and Sex			A-15 Ckl.	A-16 Ckl.	A-17 Pul.
Inoculation		Date Amt. (cc)	5/18–21 6.0	5/18–21 0.08	5/18–21 0.08
Droppings		Macro. Micro.	0 0	0 0	0 0
Autopsy		Died Killed	5/24	5/26	5/26
Cecal Content	Cecum 1	Macro. Micro.	E.B. N.Me.	S.B. N.O. N.Me.	N.B. N.O. M.Me.
	Cecum 2	Macro. Micro.	E.B. N.Me.	M.B. 0	N.B. N.O. M.Me.
Duodenum		Micro.	0	0	2x Neg.

and A-17 each 0.08 cubic centimeter. A-15 was given three cubic centimeters the first day and the other two fowls 0.04 cubic centimeter each, or a ratio of seventy-five to one.

It will be noted by the table that A-15, the large-dose fowl, died on May 24. A-16 and A-17, small-dose fowls, showed no droopiness at all and were active when killed, May 26, although both proved to be infected at this time. No doubt these two fowls would have lived in so far as coccidiosis is concerned.

The culture used for this group had been kept in suspension, considerably diluted, for twenty-six days, without any evidence

of decrease in pathogenicity. This culture was made, 65 days previous to inoculating this group, by using cecal content.

GROUP 4

This group consisted of seven fowls, hatched March 24, 1925, and raised under conditions unfavorable to coccidial development. They were inoculated June 22, 1925, with a suspension made from five cultures prepared May 20, 1925. All of the suspension was given except about one-seventh, which was placed in the refrigerator for use in connection with the next group.

Results obtained in connection with this group show that the small dose proved to be a lethal one, as in the case of group 1, and consequently no significant variation in mortality rate was noted. Six out of the seven fowls died with the severe type of coccidiosis, except one of the small-dose fowls and this fowl presented evidence of having been very seriously infected. One passed a cecal core of hemorrhagic origin on July 6, or fourteen days after the first inoculation. Autopsy, twenty-five days after the first inoculation, showed it to be almost entirely free of coccidial forms, one oöcyst being the only coccidial form found.

GROUP 5

This group was hatched March 24, 1925, and raised under laboratory conditions and on July 1 was given what remained of the suspension used in connection with group 4. In estimating the number of oöcysts given, a drop of the suspension or about 0.02 cc was placed on a slide and a direct microscopic examination was made. This was done for each fowl. The oöcysts on the slide were removed with a medicine-dropper, tap water being added several times so as to obtain as nearly as possible all the oöcysts in the drop. Microscopic examination of the slide afterwards revealed no oöcysts.

None of these fowls showed any droopiness. Coccidiosis developed in all but one which appeared to have escaped infection, as determined at autopsy, which took place seven days after inoculation. Inoculation of this group was not checked at the same time by administering a large dose for comparison, because of the small number of fowls at hand and since substantial evidence was available that a large dose would have resulted fatally.

It will be recalled that the culture used was what remained from the inoculation of group 4, which proved to be distinctly virulent nine to twelve days previous to date of inoculating

TABLE IV—*Data on group 4*

FOWL NO. AND SEX			A-18 PUL.	A-19 PUL.	A-20 PUL.	A-21 PUL.	A-22 PUL.	A-23 PUL.	A-24 CKL.
Inoculation		Date Amt. (cc)	6/22–26 1.0	6/22–26 13.0	6/22–26 13.0	6/22–26 1.0	6/22–26 1.0	6/22–26 1.0	6/22–26 1.0
Droppings		Macro. Micro.	6/28 S.B. M.Me.	6/27 S.B. 6/28 M.Me.	0 0	6/28 S.B. F.Me.	7/6* F.O.	6/28 S.B. F.Me.	6/28 S.B. F.Me.
Autopsy		Died Killed	7/1	6/29	6/27	6/28	7/17	6/28	6/28
Cecal Content	Cecum 1	Macro. Micro.	E.B. F.Me. F.O.	E.B. N.Me. M.O.	E.B. N.Me.	E.B. M.Me.	N. 6x 1 O.†	E.B. M.Me.	E.B. N.Me.
	Cecum 2	Macro. Micro.	E.B. 0	E.B. 0	E.B. 0	E.B. 0	N. 0	E.B. 0	E.B. 0
Duodenum		Micro.	0	0	0	0	3x Neg.	0	0

*Cecal core passed, 3.5 cm. x 1.25 cm. — hemorrhagic origin.
†Smear made with material from both ceca.

group 5. The remainder of ths suspension used in connection with this group was kept in a refrigerator since its preparation and for a much shorter time than a suspension used previously, which did not lose its pathogenicity as a result of this method of storage. The suspension used July 1 had been kept in the refrigerator nine days. That used for inoculating group 3 had been kept for 26

TABLE V—*Data on group 5*

FOWL NO. AND SEX			A-25 CKL.	A-26 CKL.	A-27 PUL.	A-28 PUL.
Inoculation		Date Oöcysts	7/1 300	7/1 300	7/1 500	7/1 300
Droppings		Macro. Micro.	7/7 N.B. Neg.	7/7 N.B. 6x 2 Me.	7/8* 2x 7 Me.	7/8 N.B. Neg.
Autopsy		Killed	7/9	7/10	7/11	7/8
Cecal Content	Cecum 1	Macro. Micro.	N. 3x Neg.	Reddish 1x N.O.	Core N.O.	N. 3x Neg.
	Cecum 2	Macro. Micro.	N. 1x 126 O.	N. 2x 13 O.	Core N.O.	N. 4x Neg.
Duodenum		Micro.	2x Neg.	3x Neg.	0	3x Neg.

*Two blood tinged droppings.

days after being placed in suspension and still remained pathogenic. The culture used in inoculating group 3 had been prepared 65 days at that time. That used for group 5 was 41 days old at the time of inoculation. Furthermore, the fowls in groups 4 and 5 were brooded together until separated for inoculation, which would indicate that they were of equal susceptibility.

GROUP 6

These fowls were from a commercial flock raised under conditions definitely known to be favorable to coccidial development. Their age was not definitely known, but they were probably between three and four months, certainly not over four months. They had been kept in a wire-bottom fattening-crate for several days previous to artificial inoculation.

The cultures used for this group consisted of what remained of the four cultures used to inoculate fowls April 22 and May 5 (groups 1 and 2), together with two cultures prepared June 24, 1925, and kept at room temperature. Those cultures remaining from previous inoculations had been placed in the refrigerator since being used. All the cultures were mixed to make one suspension. The large-dose fowls were inoculated from July 5 to

TABLE VI—*Data on group 6*

FOWL NO. AND SEX			A-29 CKL.	A-30 CKL.	A-31 CKL.	A-32 CKL.	A-33 CKL.	A-34 CKL.
Inoculation		Date Amt. (cc)	7/3–8 15.0	7/3–8 15.0	7/3–8 15.0	7/3 0.02	7/3 0.02	7/3 0.02
Droppings		Macro. Micro.	7/11 V.B. 7/10N.Me.M.O.	7/10 N.B. M.Me.	7/10 N.B. F.Me. F.O.	7/10 N.B. Neg.	7/9 N.B. Neg.	7/10 S.B. 1 Me.*
Autopsy		Killed	7/31	7/31	7/31	7/10	7/11	7/11
Cecal Content	Cecum 1	Macro. Micro.	N. 6x Neg.	N. 6x Neg.	N. 5x Neg.	N. 3x Neg.	N. 3x 3 O.*	N. 3x Neg.
	Cecum 2	Macro. Micro.	N. 6x Neg.	N. 6x Neg.	N. 6x Neg.	N. 3x Neg.	N. 4x Neg.	N. 3x Neg.
Duodenum		Micro.	Neg.	3x Neg.	Neg.	2x Neg.	4x Neg.	3x Neg.

*Possibly the result of previous natural infection.

July 8, 1925, inclusive, but the others were given the suspension only on July 3. The small-dose fowls were inoculated as follows: A-32, 500 oöcysts; A-33 and A-34, 300 oöcysts each and the large-dose fowls, 225,000 and 375,000 each.

All three large-dose fowls showed very distinct coccidial forms in the droppings and one discharged considerable pure blood. This fowl was the only one which showed droopiness. Only one of the small-dose fowls showed evidence of coccidiosis in the droppings. Although there was a distinct difference in the development of coccidiosis in these two groups it is apparent that fowls of the above type are not likely to be very suitable for determining the effect of doses of various sizes, because of the variable resistance to coccidoisis of fowls raised under commercial-flock conditions.

Autopsy of the large-dose fowls, twenty-eight days after the first inoculation, did not reveal the parasite, although they had all shown *Eimeria avium* in the droppings in due time following the artificial inoculation. One fowl (A-33) of the light-dose group showed three oöcysts at autopsy, eight days after inoculation. It is not improbable that these oöcysts were the result of infection previous to the artificial inoculation. Even though the light-dose fowls were autopsied seven and eight days after artificial inoculation, only one showed a trace of the parasite. In all probability autopsy of the heavy-dose fowls at that time would have revealed the parasite in goodly numbers.

Group 7

These fowls were from a farm flock which were incubator-hatched May 13, 1925, numbering seventy-five as day-old chicks. They were brooded together and had done very well both from the standpoint of growth and mortality. Their age was fifty-four days when brought to the laboratory, July 6. That at least some were affected with coccidiosis was determined by examination of the droppings. None of them showed any droopiness or lack of appetite.

Inoculation took place July 11, 1925, using three cultures prepared June 24, 1925. The number of oöcysts in the small dose was estimated by making an examination of a small drop of suspension with the low power of the microscope. The three small-dose fowls each received what was estimated to be five hundred to one thousand oöcysts and the large-dose fowls 250,000 to 500,000 oöcysts.

TABLE VII—*Data on group 7*

FOWL NO. AND SEX			A-35 CKL.	A-36 CKL.	A-37 CKL.	A-38 CKL.	A-39 CKL.	A-40 CKL.
Inoculation		Date Amt. (cc)	7/11 0.02	7/11 0.02	7/11 0.02	7/11 10.0	7/11 10.0	7/11 10.0
Droppings		Macro. Micro.	7/17–18 N.B. 0	7/17-18 N.B. 0	7/17-18 N.B. 0	7/17 reddish F.Me.	0 0	7/17 M.B. N.Me. 3 O.
Autopsy		Died Killed	7/20	7/18	7/18	7/31	7/17	7/31
Cecal Content	Cecum 1	Macro. Micro.	N. 3x Neg.	N. 4x Neg.	N. 4x Neg.	N. 6x 3 O.	E.B. N.Me.	N. 6x Neg.
	Cecum 2	Macro. Micro.	N. 3x Neg.	N. 4x Neg.	N. 4x Neg.	N. 6x 1 O.	E.B. 0	N. 6x Neg.
Duodenum		Micro.	3x Neg.	Neg.	3x Neg.	3x Neg.	N.Me	3x Neg.

All the large-dose fowls showed distinct droopiness at the end of the customary incubation period, July 17. None of the light-dose fowls showed any droopiness or blood in the droppings—it it just possible that they did not develop infection. Two of the heavy-dose fowls (A-39 and A-40) showed pure blood in their droppings and A-38 passed reddish droppings. The droppings of all the heavy-dose fowls showed coccidial forms.

Autopsy of the light-dose fowls seven and nine days after inoculation revealed no infection, while autopsy of A-38 and A-40, the only large-dose fowls remaining July 31, or 20 days after inoculation, did not demonstrate any coccidia in A-40 and a very few in A-38.

Six other cockerels, taken from the same flock as the above six, and at the same time, were inoculated July 18. Similar results were obtained in these so far as severity of coccidiosis was concerned.

Group 8

Three of the six chicks in this group were hatched May 25, 1925, and the other three were hatched June 16, 1925. Inoculations took place on July 18 and 19.

Five of the cultures used were prepared July 2, and three were prepared July 11, 1925.

Four of the chicks were given large doses and were kept together. The remaining two were given small doses and were kept by themselves. Pure blood was noted in the droppings from the large-dose group on July 24, and in those of the light-dose group, 8 a. m., July 25. Since these fowls were not separated it was not determined whether part or all of them were passing blood.

Three of the four heavy-dose fowls died and the light-dose fowls lived and were distinctly active July 29. Examination of the fowls at autopsy revealed all of them to have been infected, but the small-dose fowls only slightly.

Group 9

The fowls in this group were hatched July 29, 1925, and were raised in wire-bottom cages, so as to prevent intestinal parasitism as much as possible. They were inoculated Oct. 23 and 24, 1925, with a suspension made from three cultures, prepared July 14, 1925, and slightly less than one-half of the suspension was used. The light-dose fowls were given drops (from medicine-droppers of various sizes) of suspension containing oöcysts, estimated as

TABLE VIII—*Data on group 8*

FOWL NO. AND SEX			A-47 CKL.	A-48 CKL.	A-49 PUL.	A-50 PUL.	A-51 PUL.	A-52 PUL.
Inoculation		Date Amt. (cc)	7/18-19 10.0	7/18-19 10.0	7/19 5.0	7/19 5.0	7/19 0.05	7/19 0.05
Droppings		Macro. Micro.	* 0	0	0	0	† 0	0
Autopsy		Died Killed	7/25	7/25	7/30	7/25	7/30	7/30
Cecal Content	Cecum 1	Macro. Micro.	E.B. 4x 1 O.	‡ 0	§ N.O.	E.B. N.Me.	N. 3x 23 O.	N. 3x 63O.
	Cecum 2	Macro. Micro.	E.B. 3x 6 O.	E.B. 3x N.O. N.Me.	§ 4x 59 O. F.Me.	E.B. 0	N. 3x 65 O.	N. 3x 74 O.
Duodenum		Micro.	0	0	0	0	Neg.	3x Neg.
Hatching Date			5/25	6/16	5/25	6/16	6/16	5/25

*Four large-dose fowls kept together; pure blood in droppings, July 24.
†A-51 and A-52 were kept together; small amount of pure blood, July 25.
‡Blood and "cheesy" core.
§Cecal core of hemorrhagic origin.

TABLE IX—*Data on group 9*

FOWL NO. AND SEX			A-53 CKL.	A-54 CKL.	A-55 CKL.	A-56 CKL.	A-57 CKL.	A-58 CKL.	A-59 CKL.	A-60 CKL.
Inoculation		Date Dose	10/23–24 9,000 O.	10/23–24 20,000 O.	10/23–24 2,500 O.	10/23–24 1,500 O.	10/23–24 3.0 cc	10/23–24 3.0 cc	10/23–24 3.0 cc.	10/23–24 3.0 cc
Droppings		Macro. Micro.	10/29 M.B. 11/1 N.O.	10/29 S.B. 11/1 N.O.	10/29 S.B. 11/1 N.O.	10/29 N.B. 11/1 N.O.	10/29 V.B. 0	10/29 V.B. 0	10/29 V.B. 0	10/29 S.B. 11/2 N.O.
Autopsy		Died Killed	1/11	5/1*	*	*	5/4†	11/3	†	†
Cecal Content	Cecum 1	Macro. Micro.	N. 6x Neg.	N. 4x Neg.			N. 4x Neg.	Core‡ F.O.		
	Cecum 2	Macro. Micro.	N. 8x Neg.	N. 4x Neg.			N. 4x Neg.	Core‡ F.O.		
Duodenum		Micro.	8x Neg.	4x Neg.			4x Neg.	0		

*Identification lost, short time previously; was one of three fowls numbered A-54, A-55 and A-56.
†Identification lost, short time previously; was one of three fowls numbered A-57, A-59 and A-60.
‡Hemorrhagic origin.

follows after microscopic examination: A-53, 6,000 and 3,000 oöcysts; A-54, 5,000 and 15,000 oöcysts; A-55, 1,500 and 1000 oöcysts; A-56, 750 and 750 oöcysts. All of the fowls were given infective material at the same time on two successive days, the heavy-dose fowls receiving one and one-half cubic centimeters each time.

The difference in the severity of coccidiosis in these two groups was very distinct. The large-dose fowls were droopy and practically refused all food for one day and ate very sparingly for a longer period and further showed a decided amount of blood in the droppings. The light-dose fowls were not droopy, apparently continued to eat as usual and showed distinctly less blood in their droppings. One of the fowls (A-58) of the large-dose group died as a result of coccidiosis, during the night of Nov. 3. All of the large-dose fowls became emaciated, while the light-dose fowls showed much better flesh.

That fowls will pass cecal cores, of hemorrhagic origin and due to coccidial infection, was further demonstrated by a large-dose fowl passing such material, Nov. 4, and another of the same group passing the same type of material, Nov. 14.

Duration of Infection and Elimination of the Parasite

Table X gives information relative to the presence or absence of *Eimeria avium* in the feces, intestinal wall or content of some of the fowls used in groups 1 to 9. It also considers others not included in the above groups, but which were used in connection with other experimental work.

Fowls A-1 to A-28 and A-49 to A-62, inclusive, were raised under laboratory conditions and therefore respresented a susceptible lot. A-29 to A-34, inclusive, were obtained from a commercial poultry establishment where coccidiosis was common. A-35, A-64 and A-65 were from a commercial flock and raised under ideal, commerical poultry-farm conditions.

It is evident from a study of table X that infected fowls pass coccidial forms in the droppings in five or six days after inoculation. In most instances this ceases within a month after ingestion of the sporulated oöcysts.

Two fowls (A-61 and A-62) continued to pass *Eimeria avium* in the droppings for ninety-one and fifty-two days, respectively. A-62 was eleven days old when inoculated and A-61 was seven and one-half months old. These represent fowls which received enough sporulated oöcysts to produce severe infection. The degree

of infection possibly has some bearing on the duration of the disease, severe infection apparently prolonging the period of elimination of the parasite. A-62 and one of three of the same batch, two of which received 180,000 oöcysts and one (A-62) 90,000 oöcysts. The two receiving the larger dose died of coccidiosis at the end of the incubation period and A-62 barely survived the attack. A-61 was one of four fowls that were given a large number of oöcysts, which resulted in death of the three on the seventh, eighth and tenth days after inoculation.

Fowls A-63, A-64 and A-65 were all of the same age. A-63 and A-64 were inoculated at the same time and with material from the same source. A-63 was A-65 developed numerous oöcysts by the end of the period of incubation but the parasite very rapidly decreased in numbers to the negative point, in A-65, several days following this period. A-63 was practically free in the same length of time, one oöcyst only being found upon carefully examining five smears of droppings expelled upon three different days. A-64 developed a slight infection and was apparently entirely free of the parasite in sixteen days from time of inoculation.

A 64 and A-65 were autopsied twenty-two and seventeen days, respectively, after being inoculated. A careful examination was made and no coccidial forms were found.

General Discussion

The primary object of the inoculations was to determine whether or not varying the size of the dose affected the development of the disease. In connection with the later inoculations it was also desired to obtain some information as to approximate numbers of sporulated oöcysts given. This was to provide a basis for estimating the number of sporulated oöcysts which might be used later, in connection with investigations as to the production of resistance by experimental inoculation. As the work progressed it became evident that an estimate as to the number of sporulated oöcysts used was sufficiently accurate to insure production of coccidiosis without development of serious symptoms.

It is obvious that a wide variation in the number of sporulated oöcysts ingested does not necessarily mean a clinically distinguishable variation in the severity of the disease. This is dependent upon the relationship of the number to a lethal dose, as well as the susceptibility of the fowls used. That there may be no

TABLE X—*Data on Eimeria avium in the feces, etc.*

FOWL No.	SEX	DATE OF HATCH	INOCULATED AND DOSE	KILLED OR DIED	DAYS—1ST INOCULATION TO DEATH	DROPPINGS EXAMINATIONS	AUTOPSY FINDINGS—MICROSCOPIC		
							CECUM 1[1]	CECUM 2[1]	DUODENUM[2]
			1925						
A-1	M	3/12/25	4/22 L	K. 6/2	41	4/27 F.Me.	3x Neg.	4x Neg.	3x Neg.
A-7	F	3/12/25	4/22 S	K. 6/4	43	4/28 M.Me. 1 O.	3x Neg.	3x Neg.	3x Neg.
A-10	M	3/12/25	5/6-8 S	K. 6/5	30	5/13 M.Me. 2 O.	3x Neg.	3x Neg.	3x Neg.
A-12	F	3/12/25	5/6-8 S	K. 6/4	29	5/13 M.Me. 5 O.	3x Neg.	3x Neg.	3x Neg.
A-13	F	3/12/25	5/6-8 S	K. 6/4	29	5/13 F.Me. 27 O.	3x Neg.	3x Neg.	3x Neg.
A-16	M	4/16/25	5/18-21 S	K. 5/26	8	0	3x N.O. N.Me.	0	0
A-17	F	4/16/25	5/18-21 S	K. 5/26	8	0	3x N.O. M.Me.	0	2x Neg.
A-22	F	3/24/25	6/22-26 S	K. 7/17	25	7/6 F.O.[3]	6x 1 O.[4]	0	3x Neg.
A-24	M	3/24/25	6/22-26 S	D. 6/28	6	6/28 F.Me.	3x N.Me.	0	0
A-25	M	3/24/25	7/1 S	K. 7/9	8	7/7 Neg.	3x Neg.	1x M.O.	3x Neg.
A-26	M	3/24/25	7/1 S	K. 7/10	9	7/7 2 Me.	1x N.O.	2x 13 O.	3x Neg.
A-27	F	3/24/25	7/1 S	K. 7/11	10	7/8 7 Me.	N.O.	N.O.	N.O.
A-28	F	3/24/25	7/1 S	K. 7/8	7	7/8 Neg.	3x Neg.	4x Neg.	3x Neg.
A-29	M	3/1/25	7/3-8 L	K. 7/31	28	7/10 N.Me. M.O.	6x Neg.	6x Neg.	Neg.
A-30	M	3/1/25	7/3-8 L	K. 7/31	28	7/10 M. Me.	6x Neg.	6x Neg.	3x Neg.
A-31	M	3/1/25	7/3-8 L	K. 7/31	28	7/10 F.Me. F.O.	5x Neg.	6x Neg.	Neg.
A-32	M	3/1/25	7/3 S	K. 7/10	7	7/10 Neg.	3x Neg.	3x Neg.	2x Neg.
A-33	M	3/1/25	7/3 S	K. 7/11	8	7/9 Neg.	3x 3 O.[6]	4x Neg.	4x Neg.
A-34	M	3/1/25	7/3 S	K. 7/11	8	7/10 1 Me.	3x Neg.	3x Neg.	3x Neg.
A-35	M	5/13/25	7/11 S	K. 7/20	9	0	3x Neg.	3x Neg.	3x Neg.
A-36	M	5/13/25	7/11 S	K. 7/18	7	0	4x Neg.	4x Neg.	Neg.
A-37	M	5/13/25	7/11 S	K. 7/18	7	0	4x Neg.	4x Neg.	3x Neg.
A-38	M	5/13/25	7/11 L	K. 7/31	20	7/17 F.Me.	6 x 3 O.	6x 1 O.	3x Neg.
A-39	M	5/13/25	7/11 L	D. 7/19	8	0	3x M.Me.	0	2x N.Me.
A-40	M	5/13/25	7/11 L	K. 7/31	20	7/17 N.Me.	6x Neg.	6x Neg.	3x Neg.

TABLE X—*Data on Eimeria avium in the feces, etc.—Continued*

A-41	M	5/13/25	7/18 S	K. 7/28	10	0	3x 8 O.	3x 3 O.	3x Neg.
A-42	M	5/13/25	7/18 S	K. 7/28	10	0	3x 2 O.	3x Neg.	3x Neg.
A-43	M	5/13/25	7/18 S	K. 7/29	11	0	3x Neg.	3x Neg.	3x Neg.
A-45	M	5/13/25	7/18 L	K. 7/29	11	0	3x N.O. F.Me.	3x 3 O.	3x Neg.
A-46	M	5/13/25	7/18 L	K. 7/28	10	0	3x N. O.	3x M.O.	3x Neg.
A-49	F	5/25/25	7/19 L	K. 7/30	11	0	N.O.	4x F.Me. 59 O.	0
A-51	F	6/16/25	7/19 S	K. 7/30	11	0	3x 23 O.	3x 65 O.	Neg.
A-52	F	5/25/25	7/19 S	K. 7/30	11	0	3x 63 O.	3x 74 O.	3x Neg.
A-53	M	7/29/25	10/23-24 S	K. 1/11	80	11/1 N.O.	6x Neg.	8x Neg.	8x Neg.
A-58	M	7/29/25	10/23-24 L 1926	D. 11/3	11	10/29[7]	F.O.	F.O.	0
A-61	F	7/29/25	3/12 L	D.[8] 6/11	91	3/26 3x 18 O. 4/7 M.O. M.Me.	0	0	3x 25-50 O.
A-62	M	4/5/26	4/16 L	K. 6/7	52	4/22 N.Me. F.O. 5/17 14 Me. 2 O.	6x Neg.	6x Neg. 6x Neg.	6x 1 Me.
A-63	F	Feb. 1925	4/16 L	Alive		4/22 N.O. 4/29 3x Neg. 5/17 10x 1 O.			
A-64	F	Feb. 1925	4/16 L	K.[9] 5/8	22	4/22 3x Neg. 4/23 3x 2 O. 4/29 3x 1 O.	4x Neg.	4x Neg.	3x Neg.
A-65	F	Feb. 1925	6/5 L	K.[9] 6/22	17	6/11 N.O. 6/16 3x 2 Me.	3x Neg.	3x Neg.	3x Neg.

[1]Cecal content only.
[2]Scraping of duodenum.
[3]Passed cecal core of hemorrhagic origin.
[4]Smear made from both ceca.
[5]Age not definitely known.
[6]Possibly from infection previous to being placed in fattening crate.
[7]Droppings very bloody.
[8]Tumor of small inestine immediate cause of death.
[9]Killed by other fowls—prolapse of cloaca.
L = large dose.
S = small dose.

significant difference in the disease as determined clinically, as the result of variation in dosage, was evidenced by the results in connection with groups 1 and 4. The low dose in this case was perhaps approximately 150,000 and the high dose, 2,000,000. That a variation in dosage given in accordance with the principle of supplying lethal and sublethal doses does produce a variation in the severity of the disease, readily apparent clinically, is evidenced by the results obtained with groups 2, 3, 5, 6, 7, 8 and 9. An estimate as to the number of oöcysts given the fowls in group 2, placed the number at 5,000 for the low dose and 500,000 for the high dose. When a lethal dose was compared with a dose containing considerably less oöcysts than a minimum lethal dose the difference was very strikingly shown. Even though the dosage was sublethal in case of both large and small doses, the difference was very distinct, as was shown by seven of group 9. The heavy dose for this group proved to be a lethal one for A-58.

The fowls used in determining the effect of the size of the dose varied in age from one to four months. Not only were there variations as to the age of the various groups but there were also variations as to the conditions under which the fowls were reared; cage conditions which were favorable to coccidial elimination, commercial-flock conditions which were very unfavorable to coccidial elimination and farm-flock conditions which were conducive to previous moderate coccidial infection. While infection of the groups raised by farm- or commercial-flock methods showed a distinct variation in accordance with the size of the dose, this would not necessarily always hold true because of variation in resistance which occurs under such conditions.

Conclusions

The severity of coccidiosis in fowls of equal susceptibility to coccidial infection is chiefly dependent upon the size of the dose of sporulated oöcysts when sporulation takes place in 2.5 per cent potassium bichromate.

The disease runs a limited course and most fowls completely expel the parasite in the feces within approximately a month following inoculation.

References

[1]Johnson, W. T.: Avian coccidiosis. Poultry Sci., ii (1923), 5, pp. 150-157.
[2]Ibid: *Eimeria avium* and the diagnosis of avian cocidiosis. Poultry Sci., iii (1924), 2, p. 45.
[3]Beach, J. R., & Corl, J. C.: Studies in the control of coccidiosis. Poultry Sci., iv (1925) 3, p. 92.

Explanation of Abbreviations Used in Tables

1x, 2x, etc. = times across smear.
N. = normal.
S. B. = slightly bloody.
M. B. = moderately bloody.
V. B. = very bloody.
N. B. = no blood.
E. B. = entirely blood.
F. O. = few oöcysts.
M. O. = moderate oöcysts.
N. O. = numerous oöcysts.
1 O., 2 O., etc. = number of oöcysts.
Neg. = no coccidial forms.
0 = no determination.
Me. = merozoites.
1 Me., 2 Me., etc. = number of merozoites.
F. Me. = few merozoites.
M. Me. = moderate merozoites.
N. Me. = numerous merozoites.

Discussion

Dr. B. A. Beach: What measures do you recommend on poultry farms where the condition is known to exist? What do you tell the owner to do next year?

Dr. B. T. Simms: We have been fairly successful in rearing birds on poultry farms where losses have been very severe the past year, through following sanitary measures. Clean up and keep clean! In some instances where infection has been very severe, we have recommended the use of concrete yards for brooding purposes. These yards have been very successful. We are not yet ready to say to just what extent the concrete yard can be used, but up to the present it looks very good.

Dr. Beach: Do you recommend, on such farms, feeding from hoppers or inside of brooding-houses?

Dr. Simms: We have fed in both ways, and we have been successful both ways. Of course, we always recommend to our poultrymen that the poultry industry can not be successfully conducted on a small acreage, as many poultrymen have believed in the past. Where we can change yards, even though we are using permanent quarters to some extent, we have controlled the disease by using proper sanitary methods. We know some of those birds have become infected with coccidiosis; we do not think we have stamped it out; although the poultrymen believe we have.

Dr. E. L. Stubbs: As stated in the paper of Dr. Johnson, coccidiosis pursues a regular course and where chicks do not die, recovery follows in about one month. Is that the case in all chicks? Do all chicks quit passing oöcysts in one month?

Dr. Simms: All of those that receive sub-lethal doses, of course; I did not read the table on that, but a large number of these chicks receiving lethal doses ultimately died. Dr. Johnson has been able to predict, with a reasonable degree of certainty, the course the disease will follow, provided these chickens have been raised under proper conditions. With sub-lethal doses those chicks will almost always cease eliminating oöcysts in about thirty days. If the dose is a large one there will be plenty of evidence of coccidiosis, such as blood, or in the droppings. If the dose is a small one there will be no evidence, but nevertheless the bird will be infected and will pass oöcysts in the droppings. Occasionally he has had birds for some reason or other that failed to become infected, and the oöcysts were not passed. He has not been able to explain just why an occasional bird will show that.

Dr. W. W. Dimock: What was the diet of the experiment birds? Does it contain milk?

Dr. Simms: These birds have in some instances had skim-milk, and had it before tham at all times; and in some instances they had no milk; we have not had any experience with the control of this disease with dried milk; in

other words, our experiences have neither corroborated nor contradicted the report from California, where they controlled the disease by the use of lactose. But some of these birds have had milk, and we have observed many outbreaks where the birds have had all the milk they could drink.

DR. E. C. TEST: Is there any successful treatment for infected chicks?

DR. SIMMS: I am afraid we do not have any recommendation for a successful treatment. Catechu has been used in the past, and has been more or less successful; we have used some of it.

DR. B. H. EDGINGTON: Have you tried quinin?

DR. SIMMS: We have not tried quinin; we have tried copper sulphate, clinically, rather than in the controlled experiments, and several other remedies. We can treat coccidiosis successfully if we get to it at the right time. If we get a flock of birds in which the birds are infected severely, a lot of them have died, and the others are well on the way to recovery, then we get fair results with any treatment, but if we get there a little too soon our treatment is not very successful. (Laughter.)

VETERINARY FELLOWSHIP AT MAYO CLINIC

Through Dr. J. G. Hardenbergh we have learned that the Mayo Foundation has authorized the offering of a Veterinary Fellowship in Comparative Physiology and Anatomy. For the first year or more, the work will relate principally to the thyroid gland. The annual stipend offered is $900, $1,200 and $1,500, on a three-year basis, the continuance of the fellowship after the first year depending upon the character of work done during the first year; that is, as this is somewhat of an experiment, it has seemed best to put it on a one-year basis to start with, until it is determined how the arrangement works out. The experience that will be acquired should fit the holder of the fellowship for further research work as is carried on at experiment stations and other institutions.

The fellowship is now open and the Mayo Foundation is desirous of filling it not later than April 1. Inquiries should be addressed to Dr. J. G. Hardenbergh, The Mayo Clinic, Rochester, Minn.

VETERINARIAN SHOWS HOW

Dr. W. J. Pirie, practitioner of Springville, Iowa, and president of the Linn County (Iowa) Veterinary Association, is deeply interested in breeding Partridge Plymouth Rock chickens. At the recent shows held in Boston and Des Moines, Dr. Pirie made some remarkable winnings with his birds. These two exhibitions were held simultaneously and Dr. Pirie had birds entered at both places. At the Des Moines show Dr. Pirie almost monopolized the prizes, winning six firsts and one second.

IDIOPATHIC STREPTOCOCCIC PERITONITIS IN POULTRY*

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Primary inflammations of the peritoneum are not common in animals. Veterinary literature is meager in its records of such cases. Freidberger and Fröhner,[1] while they do not specifically describe this type of peritonitis, say that the existence of primitive peritonitis cannot be doubted. Similarly Law[2] speaks of an idiopathic type of peritoneal inflammation and, like the above, omitted a description of it. On the other hand, these writers, like many others, go to considerable length in discussing inflammations of the peritoneum—peritonitis—as a process usually following some other pathological condition. This is also the case in human medicine and, as Adami[3] puts it, "the overwhelming number of peritonitides are secondary to disease elsewhere."

In poultry, inflammations of the peritoneum are not infrequent. In the great majority of cases, the peritonitis can be demonstrated as a secondary process and in but a few as a primary one. Salmon,[4] in 1899, and more recently Ward and Gallagher[5] and Reinhardt[6] have written texts on the diseases of poultry. The chapters on peritonitis are treated particularly from the standpoint of a secondary condition. The causes of peritonitis for example are given as: infected yolk concretions; ovarian infections; inflammations of the oviduct, cloaca and other abdominal and thoracic viscera; lacerations and injuries of the alimentary canal; perforations, contusions or surgical wounds of the body-walls and septicemic diseases. That septicemic diseases are the underlying cause of peritonitis is the opinion of Fox.[7] He believes that ruptured eggs act as a foundation of peritonitis which is later completed by bacteria from the oviduct and cloaca. The peritoneal involvement in fowl cholera, according to Hutyra and Marek,[8] is sometimes so prominent a lesion that it may be considered as an independent condition. They cite an observation by Lignières and Petit in which an epizootic peritonitis in turkeys was caused by the *Aspergillus fumigatus.* Kotlan and

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Chandler[9] report the occurrence of a marked fibrinous peritonitis in chickens which was produced by a fluke parasite, a species of *Prosthogonimus*. Fitch and Kinneberg[10] observed a disease in geese characterized by a fibrinous exudate covering the liver, lungs, heart and intestines. A rod-shaped organism was found in blood-smears and preparations made from the exudate, but culture media seeded with similar material remained sterile. They designate the disease exudative septicemia, and believe it to be the same as reported by German investigators. From this one would conclude that disease of the lining membranes of the body-cavities in chickens more often occurs subsequent to disease elsewhere. The autopsy records from our laboratory add additional information to this fact. Of 72 cases of peritonitis in chickens, 64, or 89 per cent, are classified as a secondary lesion, the remainder representing a primary disease.

History of Investigation

The nucleus of the investigations herewith reported was three cases of an exudative peritonitis observed in three chickens about a year and a half ago. Before the work had progressed very far, five additional cases were obtained. The specimens were obtained from two farms, seven from a farm in Olmstead County and one from a farm in Carver County. These locations are about 125 miles apart. No communication had ever been established between the two places insofar as we could learn.

These cases and those artificially produced in the laboratory are the only cases of an idiopathic exudative peritonitis in chickens that have come to our attention. Nörgaard and Mohler,[11] in 1902, described under the caption, "apoplectiform septicemia," a disease in chickens which in some respects is similar to that reported. Apoplectiform septicemia is described as a very acute disease, whereas the disease we were dealing with was a chronic condition.

The first three cases examined showed almost an identical pathologic picture and the bacterial isolations were the same. This motivated an inspection and investigation of the flock. The flock consisted of nearly 230 birds, 77 per cent pullets and 23 per cent old hens and roosters. They were divided about equally into two separate lots and kept in separate houses. The birds were kept indoors, it being January when this inspection was made. The rations supplied the birds consisted of barley, oats, white corn fed as whole grains and a mash made from bran,

middlings, corn meal, oats and meat scrap. Beets and buttermilk were also fed. The above ration had been used for more than two months.

The disease was confined to but one of the two lots of chickens. The building in which the sick birds were kept was constructed of old stone masonry walls on which a flat roof rested. The house was fairly well lighted and was reasonably clean, but the ventilation was poor. There was a considerable amount of moisture and frost on the rafters and roof-boards which would drop to the floor and tend to keep the litter wet and damp. The house in which the second lot of chickens was kept was constructed of wood and with this exception the conditions in both places were about equal.

Losses had been occurring in the flock for more than a month. The mortality was reported to be between 50 and 60 birds, one old rooster and the remainder all pullets. Several birds died before the owner realized the seriousness of the disease. He would go through the flock once or twice each day and remove all visibly sick chickens. The sick ones were placed in isolation in a horse-barn. None of these ever recovered. The birds were sickening at a rate of from one to two each day and remained alive for from ten days to two weeks as a rule.

The clinical symptoms were studied on ten birds penned in the isolation stall. The birds sat huddled together in one corner of the stall. The neck was contracted and the head rested against the crop. The eyes were partly closed. The feathers were ruffled and lusterless. The bowel discharges were usually very soft and some were yellowish, others brownish and still others greenish in color. Food and water are not refused as a rule until the later stages of the disease. The sick birds remain on the ground and show no attempt to fly to a perch. Toward the last, the birds become prostrated and may lie about for a day or more before death ensues.

Postmortem Findings

The most significant postmortem lesions occur within the body-cavity. The visceral surface of the peritoneum is covered with a fibrinous exudate. The amount of this material and the extent of the involvement vary in different cases. In the majority of the cases which occurred under natural conditions there was a great amount of fibrinous exudate present. In our cases, an area where the liver is in direct relation to the ventral abdominal

floor was always involved by the exudative process. From here it would extend anteriorly and reach the pericardium, the air-sacs just posterior to the lungs and to the mediastinal region. The ventral surface of the liver was usually covered with the exudate. The peritoneum near the ovary, between the oviduct and the dorsal abdominal wall and the surface of the mesentery, was involved in some cases.

The exudate consists of fibrinous shreds matted together. In some cases it reached a thickness of 4 mm. It is yellow to yellow-white in color and presents a faint luster. It is not firmly attached to the underlying structures and can be lifted up with a forceps or knife-blade in rather large pieces.

The livers in some of the birds were slightly enlarged and very friable. On the surface many small, pin-point hemorrhages were sometimes observed. The kidneys were slightly engorged, dark red in color and readily injured or torn. No gross changes were observed in the heart, lungs or spleen in any of the naturally or artificially infected birds except one. In this case, a bird that had been artificially infected, a very definite proliferative valvular endocarditis occurred. Cultures from this lesion yielded pure growths of the organism which had been previously introduced. The oviducts and ovaries did not show abnormal changes in any of the affected chickens. The mucous membranes of the lower bowel showed evidence of a catarrhal inflammation in some of the cases. The ingesta was usually in a fluid or semi-fluid state.

The mucous membranes of the head were in most instances pale, except in some cases of septicemic death where they were more reddened. The bodies of affected birds were in a poor state of nutrition. The feathers were ruffled, dry and lusterless and those about the vent were usually soiled with fecal matter. In many cases, dry and crusted masses of excreta clung to the feathers near the vent.

Bacteriology

When the first specimens were presented for examination and before it was known that any particular organism was associated, heart-blood and macerated-liver filtrates from each of three chickens were injected into susceptible chickens and rabbits. The object of this was to establish the possibility of the virus of fowl pest, because only a meager knowledge of the outbreak was known at this time and we were on the watch for pest. Unfiltered heart-blood was injected into rabbits in order to determine

whether the organism of fowl cholera was present. Cultures were made also from the tissues and exudates. All the inoculated animals were alive and healthy at the end of three weeks.

The material for cultures was seeded on serum-agar slants and incubated at 37.5° C. When examined 17 hours later, there was evidence of bacterial growth in all tubes. These growths proved to be pure cultures of a streptococcus. Smears made from the peritoneal exudates showed numerous chains of streptococci. At a later date, four more chickens from the same source and one from another source were examined bacteriologically and similar organisms were obtained from each.

Morphology: The cocci were spherical in shape. They formed chains, varying in length from four to twenty elements, dependent somewhat upon the medium in which they grew. No flagella or capsules were demonstrated. They were faintly Gram-positive but stained readily with aniline dyes.

Biology: The colonies grew readily on solid or in liquid media. The solid medium used when isolating and cultivating was a beef-infusion agar, adjusted to pH 7.0 and to which was added a small quantity of naturally sterile horse-serum. Colonies on this medium appeared like little beads slightly smaller than the head of a pin and they were usually discrete. The surface was glistening. In bouillon, the growth in 24 hours was slightly clouded. Later the growth appeared flocculent and shred-like clumps would settle to the bottom of the tube and the supernatant bouillon would again become clear.

The medium used for studying the fermentation reactions was meat-infusion broth which had been fermented with *Escherichia coli* and then 1 per cent peptone and .5 per cent salt added. The reaction was adjusted to pH 7.0. To this is added 1 per cent of the test substance. It is then filtered through a Berkefeld filter and tubed. This is the method described by Fitch and Billings,[12] in 1920. The carbohydrates used in this study were inulin, lactose, mannite, raffinose, saccharose and salicin. Into each tube of the test medium .02 cc of a 24-hour bouillon culture of the organism was inoculated. Readings were made after 24, 48 and 72 hours of incubation. Lactose, saccharose and salicin were fermented while inulin, mannite and raffinose were not. The acidity was tested by using blue litmus paper as an indicator.

The appearance produced by this organism on blood-agar shows that it belongs to the Beta type of hemolytic streptococci. The colonies on blood-agar are surrounded by a clear, colorless

zone of hemolysis and when examined with a microscope there is no evidence of blood cells in the clear zone. The hemolyzed zone increased in diameter after incubation for 48 hours at 37.5°C., over the diameter at 24 hours. The hemolyzed zone about the surface colonies at the 48-hour period measured, on an average, 3.25 mm. in diameter. There were clear zones about the deeper colonies but they did not appear to be as extensive. The blood-agar plates were prepared according to the method suggested by Brown.[13]

The reaction of this streptococcus in the carbohydrates, according to the numerical classification suggested by Brown,[14] places it in group 1 and subgroup 1, and by its behavior in blood-agar it belongs to the Beta type. This places it in the *Streptococcus pyogenes* (Rosenbach) group.

Experimental Work with Chickens

It was determined that large doses of a 24-hour bouillon culture of the streptococcus, when injected intravenously and intraperitoneally into rabbits and intraperitonneally into guinea pigs, was not pathogenic for these animals. Chickens were used largely for the inoculation experiments with this organism.

The inoculum in all instances consisted of a suspension of the organism in bouillon. The organism grew readily in this medium and after incubation for 20 to 24 hours the bouillon was always definitely clouded.

Bird 1, a barred Rock hen, received 0.5 cc of the inoculum injected into a vein of the wing. The streptococcus injected was designated strain 0-0. Eight days later the bird died. The most striking postmortem finding in this bird was a definite valvular endocarditis involving both auriculo-ventricular and pulmonary valves. The right lung was edematous, the liver enlarged and friable, the spleen and kidneys swollen. No other definite changes were observed. Pure cultures of the streptococcus were obtained from the blood, liver, spleen and valvular lesions.

Bird 2, a Minorca hen, was injected similarly with the same dose and with the same strain and at the same time. After 22 days the bird appeared healthy and insofar as we could tell, never showed ill effects from the inoculation. It was destroyed, examined and cultured at this time. There were no observable gross lesions and the cultures remained sterile.

Bird 3, a Plymouth Rock rooster, was injected intraperitoneally with 1 cc of the inoculum which was prepared from the

organism obtained from bird 1 and called strain 0-1. The first time the bird seemed to show any evidence of being sick was eleven days later, when it appeared dumpish and listless. From then until the twentieth day these symptoms became more and more exaggerated. It was destroyed on the twenty-second day. The serous lining of the entire body-cavity was covered with a fibrinous exudate. The liver was swollen and very friable and the dorsal surface of the left lobe was covered with a thick exudate. There were no other particular gross changes. *Streptococcus pyogenes* in pure culture was obtained from the exudates, blood, liver and spleen.

A Leghorn cockerel (bird 4) received intraperitoneally 1 cc of strain 0-1. This bird died on the fourteenth day and at autopsy showed a marked peritonitis with a great amount of organized exudate attached to the mesentery and coils of intestine. The organism was recovered from this bird.

Strain 0-0 was injected into the peritoneal cavity of bird 5, a Leghorn cockerel, using 1 cc of the inoculum. The injection was made on the same day as birds 3 and 4. No ill effects were ever exhibited by this cockerel and it was destroyed 209 days later. The pathological and bacteriological findings were negative.

The organism isolated from bird 3 was designated strain 0-2. This strain was injected into a Plymouth Rock pullet (bird 6). The injection was made into the body-cavity and the dose was 1 cc. In ten days the bird was droopy and the evacuations were soft. This continued and became more exaggerated for another 27 days, when it died. The peritoneum near the ovary was covered with a thick exudate which had extended to the mesentery, liver and spleen. *Strep. pyogenes* and *E. coli* were isolated from the tissues.

Bird 7, a White Wyandotte hen, was injected intravenously with strain 02-0. This strain was an isolation from one of the birds obtained from the Olmstead County outbreak at the time of our visit to the farm. Its head was lowered, eyes closed, feathers ruffled and its appetite was impaired. It died 32 days after inoculation. The lesions were typical and very similar to those observed in the bird from which the organism had been isolated. The organism, *Strep. pyogenes,* was recovered from the tissues. The other bird of this group (bird 8), a young Wyandotte hen, was injected intravenously with 1 cc of strain 02-0. Three days later the bird died and the lesions at autopsy were characteristic of a septicemic death. The peritoneal sur-

face of the intestines was covered with petechial hemorrhages. Similar hemorrhages were noted on the surfaces of the heart and liver. The pericardial sac contained a large quantity of fluid. Cultures taken from the visceral organs and fluids yielded a pure culture of the streptococcus.

Two Leghorn roosters (9 and 10) were given each 3 cc of strain 02-0. The virus this time was introduced directly into the crop with a pipette. One of these birds died 127 days later, but the cause of death was not determined. The other was destroyed on the 165th day. There was no evidence of disease when examined postmortem and the cultures remained sterile. Two Plymouth Rock roosters (11 and) 12 were used to test the pathogenicity of the organism, strain C-0, obtained from the Carver County bird. One cc of a bouillon culture was injected into the peritoneal cavity of bird 11 and 1 cc into the vein of the wing of bird 12. These birds never showed signs of sickness and were destroyed 165 days later. Pathological and bacteriological examinations were negative in each case.

Bird 13, a Leghorn hen, died ten days after being injected intravenously with 1 cc of strain C-0. A fibrinous peritonitis, similar to that noted in the original specimen, was observed at autopsy. Pure cultures of *Strep. pyogenes* were obtained from these lesions. The duplicate chicken of this group, a Plymouth Rock hen (bird 14), lived 53 days. The postmortem revealed a fibrinous peritonitis, although the inflammation was mostly confined to an area near the ovary and oviduct. The organism was isolated from the exudates, liver, spleen and blood. Another Plymouth Rock hen (bird 15) was given 3 cc of the same strain per os. This had no effect upon the bird and it was destroyed 140 days later. The tissues appeared normal and inoculated culture media remained sterile.

The organism was injected into the cloaca of a Leghorn hen (bird 16). Five cc of a heavy bouillon culture of strain C-0 was introduced with a pipette. The inoculation was made very slowly and the cloaca held closed with the fingers so as to prevent the escape of the inoculum. Six weeks later the bird showed evidence of disease. It died on the sixty-seventh day. A thick exudate was spread over a large part of the peritoneum, especially the area where the liver touches the floor of the abdominal cavity. All culture tubes inoculated with material from the various organs and exudates remained sterile. A second Leghorn hen (bird 17) was given 5 cc of another culture, strain 02-0.

The inoculation was made per cloacam as in bird 16. After several weeks it began to show evidence of disease. It lived for 125 days. Death was due to inanition. All cultures remained sterile. A third hen (bird 18), treated in the same manner as the two former, never showed signs of sickness and was killed 173 days later. All organs were normal at postmortem and no bacteria were isolated.

Five cc of strain 0-0 was injected into a wing vein of Plymouth Rock hen (bird 19). Six days later the bird died. The organism was recovered from the tissues of this bird. The lesions in this individual were like those in bird 8. The same strain was used to infect bird 20, a pullet. The administration was made directly into the crop. The bird died in 49 days and, as in bird 17, inanition was the cause of death and all cultures remained sterile.

A Leghorn cockerel (bird 21) which had received an intravenous injection of 2 cc of strain C-1 was destroyed on the eighty-fifth day. There were no exudative inflammatory lesions of the peritoneum observed but a marked peri- and myocarditis was present. No definite gross changes were found in any of the other visceral organs. Cultures made from the pericardium, heart and other viscera all remained sterile. Bird 22, another male, was injected intraperitoneally with 2 cc of a culture of strain C-1. This bird was sick on the nineteenth day but lived until the eighty-fifth day, when it was destroyed. The lesions were typical of the exudative peritonitis described in the other birds. Streptococci were recovered from the exudates but not from the blood or other viscera. A third cockerel, a White Wyandotte, was injected on the same day with strain C-1. The injection was made intravenously. It was destroyed eighty-five days later. No peritonitis was found. Cultures remained sterile.

After nine months of artificial cultivation, strains 0-0 and C-0 were injected into four Leghorn roosters and three hens. The cultures were carried on serum-agar, being transplanted to fresh media about every third week. After cultivation for 24 to 26 hours at 37° C., the tubes were placed in an ice-chest until the next transplant. The cultures were always viable and grew about as rapidly as when originally isolated.

Three male birds and one female received intraperitoneal injections and the remainder intravenous. One male (bird 24) died on the fiftieth day. At autopsy we found both thyroids much enlarged. They were quite soft and fluctuating, characteristic of cystic degeneration. When the gland was incised the

walls collapsed and a semi-viscid and flocculent fluid escaped. Some of this material was inoculated onto serum-agar and glucose broth but no bacterial growth developed. Beneath the splenic capsule a reddish, gelatinous material had collected. This material was sterile when cultured. Blood cultures and cultures from the visceral organs did not show evidence of bacterial growth. None of the other birds showed any evidence of disease when destroyed and examined sixty-one days later. All cultures from these birds remained sterile. It was quite evident that the organisms were now non-pathogenic. Their reactions on blood-agar and in carbohydrates were the same as when tested at the earlier period.

Summary and Discussion

Excluding the eleven birds just mentioned above in making comparative summaries and including only those receiving pathogenic strains, the following summarized data are given:

Twenty-three birds were utilized in this study, thirteen females and ten males. Two birds of each sex were given large doses of the inoculum directly into the digestive tube. This method of administration never induced disease in these birds. This result would indicate that under natural conditions infection does not take place in this manner. Under natural conditions there are factors of environment which can not always be duplicated in the laboratory, as for instance the house in which the birds were kept on the farm in Olmstead County was poorly ventilated so that the floors and litter were damp and cold. The vitality and natural body resistance of a bird under such conditions tends toward greater susceptibility. The artificially infected birds were kept under very good conditions.

One of three hens in which the virus was introduced into the cloaca died from peritonitis. The two that remained well were inoculated with a strain of the organism that had caused typical cases of fibrinous peritonitis in the two hens that were injected intravenously. The organism was therefore considered pathogenic. Cloacal infection under natural conditions might occur although we have but little evidence to support this view.

In ten instances the inoculations were made directly into the blood-stream. Of the females infected in this manner 85.7 per cent showed definite evidence of peritonitis when examined post-mortem. Four of the birds especially showed lesions which were similar with regard to the nature of the exudate and location of the lesion as found in some of the original chickens examined.

This adds support to the opinion of Rosenow[15] with respect to an elective localization of the organism. The hen that did not show evidence of disease was one that was destroyed twenty-two days after inoculation. This hen might have developed the disease if allowed to remain for a longer period, because some of the injected chickens did not die until between the fiftieth and seventieth days. Not a single male bird infected in this manner sickened or died.

As intravenous inoculations of virulent cultures of streptococci produced fibrinous peritonitis in a large proportion of birds injected, it might be expected that intraperitoneal injections of similar cultures would induce the disease. This method of infection was used on five males and one female. The female died in twenty-seven days. A well-marked peritonitis was observed at postmortem. Of the five males so treated, three showed well-developed cases of fibrinous peritonitis at autopsy.

Male birds are apparently much more resistant to *Streptococcus pyogenes* than are females. Of the females injected intraperitoneally or intravenously with virulent cultures of the organism, 87.5 per cent developed disease, while of the males, only 37.5 per cent developed disease. The peritoneum of birds is in general more resistant to infection than the peritoneums of other animals and man. Friedberger and Fröhner place birds last among the different species of animals in the scale of sensitiveness of the peritoneum to infection. This we believe is warranted, basing our opinion on the records in our laboratory where less than 75 of nearly 3000 avian autopsies showed evidence of peritoneal inflammation.

In three instances the birds died from a septicemic type of disease. No local peritoneal reaction was seen in any of these cases. The virus in each instance had been introduced directly into the blood-stream and the organisms were recovered from each case at postmortem. Peritonitis due to *Streptococcus pyogenes* in man, according to Osler,[16] is the most severe and fatal form. Delafield and Prudden[17] state that bacteria are the usual excitants of acute peritonitis and *Streptococcus pyogenes* and *Staphlycoccus pyogenes* are most frequently present. Streptococci were isolated from the exudates and blood of children showing extensive fibrino-purulent peritonitis and pleuritis by Ransohoff and Greenebaum.[18] Law[2] cites certain observations of Fränkel in which he isolated *Streptococcus pyogenes* from seven cases of human peritonitis. The cases represent acute forms

of the disease and can be explained on the basis of peritoneal resistance and susceptibility.

Streptococci apparently do not play an important role as causative agents in poultry pathology. Few instances are recorded where streptococci are described as the excitants of morbid processes in birds. In 1902 Nörgaard and Möhler[11] described a very fatal disease of chickens that was caused by a streptococcus. Dammann and Manegold,[19] in 1905, and Greve,[20] in 1908, isolated a capsulated streptococcus from birds affected with sleeping sickness. From our own records for the past nine years streptococci were isolated from chickens only once (accession 1143), in April, 1920, excepting those cases described in this report.

Conclusions

1. An idiopathic or primary fibrinous inflammation of the peritoneum of poultry has been observed.

2. This type of peritonitis is not common. The greater number of peritoneal affections are secondary to disease elsewhere in the body.

3. A streptococcus, *Streptococcus pyogenes*, was isolated. This organism when injected into susceptible birds produced a disease typical of the original cases.

4. The disease under natural conditions and in several birds artificially infected has a chronic course.

5. Peritonitis was not induced in susceptible birds under artificial conditions by administering the virus directly into the digestive tube.

6. Females are more susceptible than males.

7. The organisms were avirulent after nine months of artificial cultivation on serum-agar. Their ability to cause hemolysis or ferment lactose, saccharose and salicin was not changed.

References

[1]Friedberger & Fröhner: Pathology and Therapeutics of the Domestic Animals (1895), I, p. 316.
[2]Law, James: Text Book of Veterinary Medicine (1900), II, p. 380.
[3]Adami, J. George, & Nicholls, Albert G.: Principles of Pathology (1909), II, p. 506.
[4]Salmon, D. E.: The Feather Library (1899), I, p. 127.
[5]Ward, A. R., & Gallagher, B. A.: Diseases of Domestic Birds (1920), p. 174.
[6]Reinhardt, Richard: Handbuch der Geflügel Krankheiten (1922), p. 209.
[7]Fox, Herbert: Disease in Captive Wild Mammals and Birds (Philadelphia, Lippincott, 1923), p. 261.
[8]Hutyra, Franz, & Marek, Josef: Special Pathology and Therapeutics of the Diseases of Domestic Animals (1913), II, p. 572.
[9]Kotlan, A., & Chandler, W. L.: A newly recognized fluke disease (prosthogonomiasis) of fowls in the United States. Jour. A. V. M. A., lxvii (1925), n. s. 20 (6), pp. 756-763.
[10]Fitch, C. P., & Kinneberg, O.: Corn. Vet., x (1920), pp. 211-214.
[11]Nörgaard, Victor A., & Mohler, John R.: U. S. Dept. Agr., B. A. I. Bul. 36 (1902).
[12]Fitch, C. P., & Billings, W. A.: Jour. Bact., v (1920), p. 470.
[13]Brown, J. H.: Rockefeller Inst. Med. Res. Monograph No. 9 (1919), p. 12.
[14]Ibid. Table II.
[15]Rosenow, E. C.: Jour. Inf. Dis., xxxiii (1923), pp. 248-268.
[16]Osler, William, & McCrea, Thomas: Modern Medicine. (2nd ed.; 1914) III, p. 674.
[17]Delafield, Francis, & Prudden, T. M.: Text-Book of Pathology. (11th ed.; 1919) p. 790.
[18]Ransohoff, Louis, & Greenebaum, J. Victor: Arch. Pediatrics, xlii (1925), pp. 315-323.
[19]Dammann, G., & Manegold, O.: Deut. Tierärzt. Wchnschr., xiii (1905), pp. 577-579.
[20]Grieve, L.: Deut. Tierärzt. Wchnschr., xvi (1908), pp. 213-215.

BIOLOGICAL AND MEDICINAL AGENTS FOR POULTRY*

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There are various measures recommended for the control and treatment of the diseases affecting poultry. Some of these biological and medicinal agents are of much value. Their merit has been established by painstaking investigators and confirmed by field tests. However, there are others that are of questionable value when subjected to careful investigation. Many veterinarians are employing preventive and curative agencies in their practice with apparently good results, while others of equal ability and working under similar circumstances feel that these same substances are of little or no value.

Progress has been made during the past few years in determining the true value of many biologics and medicaments used for poultry. An effort will be made to call to your attention those agents that at this time are considered to be most effective in dealing with the parasitic and infectious diseases of fowls.

EXTERNAL PARASITES

Of all insecticides advocated for the destruction of lice, nothing has been found to be as satisfactory as commercial sodium fluorid.[1] This chemical is very poisonous to all species of poultry lice. A single application will destroy all of the lice on a fowl. Sodium fluorid may be applied as a dust or as a dip. In the dry form its action is rather slow. Usually all lice will disappear in from four to five days and young lice apparently are killed as they emerge from the eggs. Lice are destroyed much more quickly by dipping. This is applicable only when weather conditions are favorable. For the dipping solution one ounce of sodium fluorid is dissolved in a gallon of tepid water.

Nicotin sulphate is also an effective remedy against lice when used in the form of an ointment or as a powder.[2] The ointment may consist of 1 part of 40 per cent nicotin sulphate, 50 parts of vaselin and 49 parts of tallow and lard.

The feather mite (*Liponyssus silviarum*) has been reported as occurring in different parts of the United States during the past

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few years. It has recently been found in Ohio. This mite may be destroyed by thoroughly dusting the fowls with flowers of sulphur. A more efficient method is to dip the birds in a solution containing 2 ounces of flowers of sulphur and 1 ounce of soap to the gallon of water. This solution should be stirred to keep the sulphur in suspension while dipping.

Mites and lice which infest poultry-houses can be destroyed by the use of an insecticide spray. High-grade anthracene oil, such as commercial carbolineum, has proved very efficient against the common red mite. To improve its spraying quality it is often thinned with 1 part of kerosene to 3 parts of carbolineum.

Internal Parasites

Flock treatment for the removal of internal parasites from poultry is always popular with the poultryman. However, much greater accuracy of dosage is assured when administered to the individual fowl and the results obtained will usually offset the inconvenience and possible harm that may result from handling the birds.

Two vermifuges, nicotin sulphate and carbon tetrachlorid, have been recommended by the California Station for roundworms. Carbon tetrachlorid is considered very efficient and safe but is more expensive than nicotin sulphate. Adult fowls are given 3 cc in a capsule. Nicotin is too toxic to be administered alone and is therefore mixed with Lloyd's Alkaloidal Reagent and placed in gelatin capsules, each capsule containing 0.12 cc of 40 per cent nicotin sulphate and about 0.3 gm. of Lloyd's Alkaloidal Reagent. The gelatin capsule prevents the absorption of nicotin before it reaches the intestinal tract. Roundworms are removed within two days.

There has been an urgent need for a satisfactory anthelmintic to remove tapeworms from fowls. Kamala is probably a dependable teniafuge and the individual treatment is recommended.[3] The therapeutic dose is 1 gram and fowls will tolerate 10 grams without harmful effects. It is administered in pills and capsules. In pill form it is possibly more effective. Fasting does not appear to be essential. Kamala causes purgation, therefore the use of other purgatives is not necessary. However, fasting and purgation may in some instances aid in the removal of the worms. In flock treatment from 2 to 3 grams of kamala per bird are given in a dry mash.

A report has been recently received concerning losses in young turkeys following the administration of a teniafuge. Sixty-nine poults, about five weeks old, were given each a capsule containing 10 grains of kamala and 5 grains of oleoresin of male fern, which had been prepared by a commercial laboratory. All of the young turkeys were sick three hours after the treatment and fifty-nine of them died within about twenty-four hours. The owner in this instance had been instructed by his veterinarian not to feed the turkeys for twelve hours but to let them have free access to water; then give the capsule and, a few hours later, to feed a bran mash moistened with water, the water containing two grains of corrosive sublimate to the quart. This case is cited to call your attention to the possible danger of treating young turkeys for tapeworms.

Turpentine is also useful as an anthelmintic. It may be diluted with olive oil or mineral oil and administered by way of the mouth. The mineral oil has the advantage of being cheaper. A convenient method of administration is by means of a volumetric pipette with a blunt point which can be inserted directly into the crop. The dose per bird is from 4 to 6 cc in 15 cc of oil. The fowls should be fasted for about a day and receive a dose of Epsom salt. A few hours after the administration of turpentine another laxative dose of salts is given.

The feeding of lactose appears to be very important in controlling coccidiosis in chicks.[4] A mash containing 40 per cent of dry skim-milk or buttermilk has been recommended and is to be fed when the first symptoms of coccidiosis appear or during the period of greatest danger, when the chicks are usually from four to eight weeks of age. Sufficient quantity of milk sugar must be consumed continuously to maintain acidity in the intestinal tract. The acidity produced in the ceca by the lactose seems to be injurious to some forms of the coccidia and the milk also stimulates rapid growth of the chicks, which increases their natural resistance.

Quinin sulphate has been recently suggested for treating coccidiosis in poultry.[5,6] About ¼ to ½ grain of quinin sulphate per chick is thoroughly mixed with dry mash. This is moistened to make it crumbly and is fed for a number of days. A laxative dose of Epsom salt should be given before and following the treatment. Quinin sulphate in the drinking water has been recommended, using one teaspoonful to a gallon of water.

Vaccines, Bacterins and Aggressins

The vaccination of fowls against various infectious diseases has been studied by investigators for many years. At present there is still a great difference of opinion as to the value of vaccination in the poultry industry.

Some investigators have reported failure to secure immunity in fowls by the use of the various hemorrhagic septicemia or mixed infection bacterins and aggressins recommended for the prevention and control of fowl cholera and roup. However, others recognize that the products have their limitations, but consider them good tools in the hands of skilled workers and when properly used will serve an excellent purpose. Bushnell and Patton[7] have suggested that a vaccine must be antigenic to be of value and the best method of selecting strains of organisms for the production of vaccines is by conducting protective tests.

Weil,[8] working with aggressins, prepared according to the method of Bail, was able to produce an aggressin, a single injection of which would protect fowls, pigeons, guinea pigs and rabbits against a subsequent lethal injection of cholera organisms. To determine the merit of hemorrhagic septicemia aggressin as an immunizing agent against fowl cholera the following preliminary experiments were conducted at the laboratories of the Ohio Department of Agriculture: An aggressin was obtained from a commercial laboratory and sixteen chickens were used in the first test. Eight of them were injected subcutaneously each with 1 cc of the aggressin as recommended, while the remaining eight were used as controls. Thirty-nine days later these birds were injected with blood from a fowl that had died of cholera. Fifteen of the fowls became sick and died of cholera. One bird that had been treated with aggressin became sick, but recovered. In another experiment five chickens were employed. Three were injected with 1 cc of hemorrhagic septicemia aggressin. Forty-six days following the injection, they were fed the liver and spleen of a fowl affected with cholera. They all died of cholera with the exception of one control bird. This fowl was later found to be immune when injected with a virulent fowl cholera organism.

Under field conditions, prophylactic vaccination may in some cases be of sufficient assistance to tide fowls over a danger period. However, such results are subject to criticism when

considered from a scientific point of view. In the control and treatment of such diseases as fowl cholera, roup and typhoid, consideration must be given to isolation or slaughter of the infected birds, thorough cleaning and disinfecting of buildings, proper housing and diet. Success can not be obtained by the use of vaccines, bacterins and aggressins unless consideration is given to that cardinal factor—sanitation.

Tuberculin

Tuberculin is a product of much value in poultry practice. A tuberculin test not only determines the presence of tuberculosis in a flock, but also designates the extent of the infection. Many practitioners cull and inject the tuberculin in one handling of the fowls. A flock should be culled at least twice a year, preferably from July to October, and in the culling all birds that are emaciated, undersized and of low vitality should be rejected. This is especially important in connection with the tuberculin test, as badly infected fowls will seldom react and should be removed from the flock on physical examination. Emaciation from tuberculosis is best determined by palpation of the muscles of the breast, as they are often markedly atrophied.

Experience is necessary to obtain good results with the intradermal injection of avian tuberculin. It is best to use a half-inch, 25-gauge needle and inject the tuberculin as close to the surface of the wattle as possible. Only one wattle is injected, the other being used as a control. The swelling is generally most pronounced about forty-eight hours after the tuberculin has been injected. Freezing of the wattles must be avoided, as it is difficult to differentiate a frost-bite from a tuberculin reaction.

Intradermal Test for S. Pullora Infection

The agglutination test for the detection of fowls infected with *S. pullora* is generally considered to be very reliable. However, the complicated method that is required to conduct this test makes it rather expensive. For that reason a simpler, less expensive and equally accurate diagnostic method would be of great aid in eliminating infected breeding stock. Ward and Gallagher,[9] in 1917, proposed a test of this nature which is very similar to the intradermal tuberculin test used for fowls. The best results were obtained with a culture of *S. pullora* that had been grown for a month, then carbolized and held for several weeks. In their experiments a swelling of the wattle following injection

with this product indicated the presence of infection. About 30 hours was considered as being the proper time to make readings and a slight swelling of the wattle should be regarded as significant. It was found that there was complete agreement between the agglutination test, intradermal test and autopsy in 70 per cent of the cases. The absolute disagreements were very small, which indicated that the two tests are about equally reliable.

Scherago and Benson,[10] in 1919, reported their work with the intradermal test and concluded that it was of little value as a diagnostic agent in detecting infected fowls. The use of the intradermal test caused at least 85 per cent of the birds to react positively to the agglutination test, regardless of their reactions to the original tests.

In 1923, Fuller[11] reported some experiments with the intradermal test. He showed that only a very small percentage of non-carriers react to the test and it is much simpler and easier to perform than the agglutination test. It detected a large percentage of infected fowls, but did not detect them all in a heavily infected flock.

A number of experiments have been made by the Department of Agriculture of Ohio, to determine the reliability of the intradermal test as a diagnostic agent, especially when it is compared with the agglutination test.

The intradermal fluid for these tests was prepared by growing a number of strains of *S. pullòra* on agar for forty-eight hours. The culture was then washed with sterile distilled water and centrifugalized. The organisms were washed in this manner four times, then carbolized and allowed to stand until killed. The washed organisms were diluted with a 0.5 per cent phenol solution to a density of the first tube in a McFarland nephelometer. This material was injected with a 25-gauge needle and as near the border of the wattle as possible. Readings were made in from 28 to 30 hours after the injection. A slight thickening at the point of injection was considered as doubtful and a perceptible swelling as a positive reaction.

The results obtained by the intradermal and agglutination tests in a flock of fifty Rhode Island Red hens may be of interest. The blood samples were drawn and the wattles injected April 1, 1926. Thirty-four of the fowls were negative to both tests. Sixteen reacted to one or both tests. Two reacted positively and one doubtful to the agglutination test, while two were posi-

tive and fourteen considered doubtful to the intradermal test. A retest of all doubtful and positively-reacting fowls was made about three months later.

TABLE I—*Reactions obtained with intradermal and agglutination tests.*

	TESTED APRIL 1-2, 1926		RETESTED JUNE 29-30, 1926		
FOWL	INTRA-DERMAL	AGGLUTI-NATION	INTRA-DERMAL	AGGLUTI-NATION	AUTOPSY
4	?	—	—	—	
21	?	—	?	—	Ovarian lesions
23	?	—	—	—	
25	?	—	Died		
26	?	—	—	?	Ovarian lesions
30	?	—	Died		
31	+	+	+	+	Ovarian lesions
32	?	—	—	—	
33	?	—	—	—	
36	?	+	?	+	Ovarian lesions
37	?	—	—	—	
46	?	—	—	—	
47	?	?	+	?	Ovarian lesions
48	?	—	—	—	
49	+	—	+	?	Ovarian lesions
50	?	—	—	—	

+ = positive; — = negative; ? = doubtful.

On the retest, five reacted to each test, but there was a disagreement in birds 21 and 26. Postmortem examinations held on the six fowls revealed lesions of the ovary that are considered characteristic of *S. pullora* infection. Some of the ova were angular and hard, while others had changed to a greenish or dark-brown color. It will be noted that eight of the fowls classified as doubtful to the intradermal test were negative to both tests three months later. The injection of the material did not cause these fowls to become positive to the agglutination test.

A flock of thirty-one Buff Minorcas was tested April 7, 1926, with the intradermal and agglutination tests. None of the fowls reacted positively to either test. The history of this flock would indicate that no infection was present, as no losses occurred in the chicks hatched from eggs produced by the fowls. On July 27, 1926, a retest was made of twenty-five of these fowls and no positive reactions were obtained by the agglutination test or the intradermal test.

Our experience to date indicates that agar cultures of *S. pullora*, when thoroughly washed and killed by phenol, will not

cause fowls to react positively to the agglutination test after three months, at least not in the amounts used for the intradermal test.

The intradermal test is of value in detecting infected fowls. Like all biological tests it has its limitations. Great care must be exercised in injecting the test fluid and experience is necessary to interpret the results properly. It is advisable to make a retest of all fowls giving doubtful reactions. Whenever possible the intradermal test should be used in combination with the agglutination test.

REFERENCES

[1]Bishopp, F. C., & Wood, H. P.: Mites and lice on poultry. U. S. Dept. Agr. Bul. 801.
[2]Eriksen, S.: Mo. State Poultry Asso. Year Book 1923-24.
[3]Hall, Maurice C., & Shillinger, Jacob E.: Kamala, a satisfactory anthelmintic for tapeworms in poultry. No. Amer. Vet., vii (1926), 3, pp. 51-58; 4, pp. 52-56.
[4]Beach, J. R., & Davis, D. E.: The influence of feeding lactose or dry skim-milk on artificial infection of chicks with *Eimeria avium*. Hilgardia, i (1925), 8.
[5]Patterson, John: A field experience with internal parasites of chickens. Jour. A. V. M. A., xix (1926), n. s. 22 (2), pp. 228-230.
[6]Johnson, E. P.: Quinin sulphate for treatment of coccidiosis in poultry. Jour. A. V. M. A., lxix (1926), n. s. 22 (5), pp. 635-637.
[7]Bushnell, L. D., & Patton, J. W.: The use of vaccines in poultry diseases. Poultry Sci., iv (1925), 2, pp. 64-73.
[8]Weil, E.: Untersuchungen über Infektion und Immunität bei Hühnercholera. Arch. f. Hyg., lii (1905), pp. 413-432.
[9]Ward, A. R., & Gallagher, B. A.: An intradermal test for *Bacterium pullorum* infection in fowls. U. S. Dept. Agr. Bul. 517 (1917).
[10]Scherago, M., & Benson, J. P.: Experiments on the intradermal test for *Bacterium pullorum*. Corn. Vet., ix (1919), 2, pp. 111-117.
[11]Fuller, J. W.: The intradermal test for detecting fowls carrying *Bacterium pullorum*. N. Y. State Vet. Col., Rpt. (1922-23), pp. 59-61.

K. S. A. C. VETERINARY CONFERENCE

Dean Dykstra has announced the complete program of the sixth annual veterinary conference to be held at the Kansas State Agricultural College, Manhattan, February 9-10, 1927. Dr. E. J. Frick will preside over the morning session on the first day, which will be devoted largely to poultry diseases. Dr. J. H. Burt will preside over the afternoon session, which will be devoted to equine and porcine problems. Dr. H. F. Lienhardt will preside over the morning session on the second day, when sheep problems will be discussed, together with small animal practice and a number of other important subjects. Dean Dykstra will preside over the afternoon session, when a mixed program will be presented. Among the out-of-state contributors to the program will be Dr. F. B. Hadley, Madison, Wis.; Dr. T. A. Sigler, Greencastle, Ind.; and Dr. Cooper Curtice, McNeill, Miss. The Veterinary Corps of the United States Army will be represented by Lt. Col. Jules H. Uri. Members of the K. S. A. C. faculty and several Kansas practitioners will contribute the balance of the program.

RESULTS OF WHITE DIARRHEA INVESTIGATION*

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Until a few years ago it was thought that white diarrhea infection of chickens did not exist in Wisconsin. Much to our surprise, however, when a few flocks were tested, reactors were disclosed.

In order to ascertain the prevalance of this infection, its importance to the poultry industry and the efficiency of the agglutination test in ridding flocks of pullorum infection, the following investigations were undertaken.

Flock Investigation

During the fall and winter of 1922-23, about one thousand hens on a large poultry farm were tested by the agglutination test for white diarrhea infection. Approximately eleven per cent gave a positive reaction. This was somewhat surprising, in view of the fact that no unusual trouble had been experienced in brooding the chicks.

Some of the reacting hens had been pedigreed during the hatching season, and examination of the records revealed the fact that the fertility and hatchability of the eggs and the viability of the chicks were just as good from the reacting as from the non-reacting hens. These reacting hens were isolated and the following spring the eggs were incubated and the chicks brooded with good results.

More Critical Tests

A more critical test was planned and consummated during the summer of 1924.

A pen of fifty-five hens was selected. Twenty-seven of the hens had given a positive reaction to the agglutination test at some time during the previous eighteen months and fifteen were positive at the time the experiment was started. The others were negative to all agglutination tests. All the eggs were incubated; the infertile and dead germs were cultured. Approximately one-half of the chicks that hatched were immediately

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killed and cultured and the remainder were brooded in the usual manner.

In three of these the organism of white diarrhea was demonstrated. In thirty-seven there was growth of organisms other than white diarrhea. Of the three times the specific organism was found, two were from eggs laid by hens giving a positive reaction to the agglutination test, and the other from a hen that had given a questionable reaction.

There were one hundred eighty-two chicks cultured. This number included those killed at the time of hatching and those that died during the brooding process. In three of these only was the organism of white diarrhea demonstrated. One of these chicks was from a hen that had reacted positively two years before and since that time she had been negative. One was from a positive-reacting hen. The other was from a hen that had always given a negative reaction. Growth of organisms other than white diarrhea was demonstrated in sixty-one chicks.

The chicks which were brooded from these hens were apparently normal in every way and the brooding mortality was low, with no appreciable difference between the two groups.

In table I will be found the various reactions of the hens to the agglutination test, the number of eggs and chicks cultured and also the brooding mortality of the chicks. It will be seen that there is little difference between the reacting and non-reacting hens as regards the hatchability of the eggs and the livability of the chicks.

The results of repeated testing with the agglutination test are interesting. A group of fifty-five hens was tested four times, in three consecutive years, at the University of Wisconsin. Only one gave a positive reaction to all tests. Fifteen gave a positive reaction to the first test. Four of the fifteen reacted positively to the second test. Nine gave a negative reaction to the second test that had reacted positively the first time. None that had reacted negatively the first time gave a positive reaction the second time and eight that had failed to react the second time gave a positive reaction to the third test. Three gave a positive reaction the fourth time that had been negative the third time. One that had failed to react at all other times reacted positively. Twenty-two failed to react at any time.

Variations of Reactions in Thirteen Months

In table II will be found the reactions of fifty-six hens, tested eleven times in thirteen months.

It will be seen that there is great variation in the reactions exhibited by these hens. In fact most of them could have been considered either positive or negative, depending on the time at which the test was made.

It is observations such as this that has made us doubt the

TABLE 1—*Results of bacteriological examinations and agglutination tests*

HEN	EGGS CULTURED. NO GROWTH	EGGS CULTURED. GROWTH	EGGS CULTURED. *B. pullorum*	CHICKS KILLED AND CULTURED. NO GROWTH	CHICKS KILLED AND CULTURED. GROWTH	CHICKS CULTURED. *B. pullorum*	AGGLUTINATION TESTS			
							OCT. 22	JAN. 24	JUNE 24	JAN. 25
H-160	18	1	0	0	1	0	0	0	0	+
H-332	8	0	0	6	0	0	0	0	+	
H-337	2	0	0	0	0	0	++			
H-376	3	0	0	0	0	0	++	+	+	
K- 53	5	1	0	1	0	0	0	0	0	0
K- 74	9	2	0	3	1	0	0	0		0
K-168	12	1	1	3	0	0	?	0	?	
K-227	7	0	0	0	0	0		0	0	
K-241	10	0	0	2	2	0		+	+	0
K-291	7	0	0	0	2	0	?+	0	++	
K-677	13	1	1	2	0	0	0	0	++	
K-192	0	1	0	0	0	0			++	
K-756	8	1	0	3	5	0	0	0	0	0
K-759	4	0	0	0	1	0	0	0	0	0
K-762	4	0	0	0	0	0	0	0	0	0
K-763	5	1	0	0	0	0	0	0	+	
K-766	7	1	0	1	1	0	0	+	0	
K-855	4	0	0	4	3	0	0		0	
K-861	8	2	0	3	3	0	+	0	0	
K-865	26	0	0	0	1	1	0	0	+	
K-946	10	2	0	0	0	0	0		0	0
K-947	6	1	0	6	5	0	0	+	0	0
K-962	1	0	0	1	0	0	0	0	0	0
K-967	9	0	0	1	0	0	0	0	0	0
498	1	1	0	0	1	0		0	0	
M- 25	7	1	0	5	5	1		0	0	0
M- 26	15	1	0	3	2	0		0	0	
M-244	19	1	0	0	1	0		0	0	
M-271	13	0	0	0	0	0	0	0	0	0
M-280	8	1	0	3	3	0	+	0	+	0
M-283	20	1	0	3	0	0	+	0	+	0
M-302	8	1	0	7	2	0	0	0	0	0
M-307	20	2	0	2	0	0	+	0	0	+
M-309	22	0	0	2	5	1	+	0	0	0
M-310	10	2	0	0	1	0	+	0	0	
M-312	21	0	0	3	2	0	0	0	0	0
M-316	9	1	0	5	2	0	0	0	0	0
M-319	15	1	0	5	2	0	0	0	0	0
M-327	15	1	0	5	2	1	+	0	0	+
M-332	16	2	0	6	0	0	+	0	0	
M-333	1	0	0	0	0	0	+	0	0	
M-334	19	0	0	3	0	0	+	0	0	0
M-336	9	2	0	2	0	0	0	0	0	0
M-337	17	3	0	1	0	0	+	0	+	
M-410	7	0	0	1	4	0		0	0	
M-512	1	0	0	0	0	0	0	0	0	
M-523	5	1	1	4	2	0	0	+	0	
M-537	7	0	0	0	0	0	0	+	0	0
M-567	18	2	0	2	1	0		0		0
M-569	7	0	0	2	0	0			0	
N- 76	5	0	0	0	0	0	0	+	+	0
J-483	1	0	0	0	0	0	+	+	+	+
M-563				3	2	0	0	+	0	
M-466	13	0	0	5	4	0	0		0	0
H-376	3	0	0	1	0	0	+	+	+	0
Totals	**518**	**37**	**3**	**113**	**66**	**4**				

efficiency of the test as a practical means of eradicating pullorum infection.

Disregarding for the moment that importance of the infection to chick mortality if the agglutination test is not accurate, the

TABLE II—*B. pullorum test. Experiment hens*

HEN	6-20-25	9-25-25	11-18-25	12-22-25	2-1-26	3-9-26	4-8-26	5-6-26	6-22-26	7-10-26	7-25-26
3	+	+		+	+	+	+	+	+	—	+
8	+	+									
11	+			+	+	+	+	+			
13	+	+		—	+	+	+	+	+	+	—
15	+	—		+	+						
16	+	+	—								
17	+	+		—							
20	+										
25	+	+		—	+	+	+	+	+	+	+
29	—		—	+	+	+	+	+			
30	—		+	—	—	+	—	—	+	—	+
31	+		+	+	+	Killed					
32	+	+									
35	+	+		—	+	+	+	+	+	+	+
38	+	+		+	+	+	+	+	+	+	+
40	+	+	—	+	+	+	+				
42	+	Died									
44			+	—							
45	+	+									
46	+	+			+	+	+	+	+	+	+
56	+	+									
57	+	+		—	—	—	—	—	+	—	+
58	+		—	+	+	+	+	—	+	+	—
62	+			+	+						
65	+		+	+							
71	+			+							
79	+			+							
82	+		+	+	—	+	+	+	+	+	Killed
84	+	—		—	+	+	—	+	+	+	+
89	+			+							
91	+	+									
94	+										
98	+		—								
99	+		+	+	+	—	+	+			
100	+	+		—	—	—	+	+			
228	+		—	+	—		+	+			
229	+	+	—	Killed							
233	+			+	—	—	—	—	—	—	—
245	+										
246	+	+		+	+	+	—	—	+	—	—
247	+	+		—							
O975		+		+	+	+	+	+	+	+	+
O991				+	+	+	+	+	+	+	+
O995				+	+	+	+	Dead			
O997				—	—	+	+	+	+	+	—
P276				—	—	+	+	+	+	+	+
P277				—	—	—	+	—	+	—	
P337				—	—	—	—	—	—	—	—
O989				—	—	—	—	+	—	—	—
O998					—	—	—	—	—	—	—
O985					—	—	—	—	+	—	—
O999					—	—	—	—	+	—	—
O992					—	—	—	—	+	—	—
O996					—	+	—	+	+	+	+
P338					—	—	—	—	+	—	—
O981				—	—	—	—	—	—	—	—
O987				—	—	—	—	—	—	—	—
P336					—	—	—				
P339					—	—	—	—			
O993					—	—	—	—			
O984					—	—	—	—			
O988					—	—	—	—			
O990					—	—	—	—			
O994					—	—	—				

poultry industry is better off with no testing at all because of the false sense of security that an inaccurate test implies. As far as we have been able to discover there has been but little critical investigational work conducted bearing on the efficiency of the test. The results of such observations as have been made seem to indicate that this test as ordinarily conducted is not accurate. From one of the southwestern states somes a report to the effect that blood samples sent to three different laboratories gave widely divergent results as regards their ability to agglutinate pullorum antigen.

We are reporting the results of this investigational work in the hope that other critical tests will be run. It is not our belief that the final answer has been found to any of these questions.

In Wisconsin we have adopted, temporarily at least, the following plan: Where flocks are found from which, for any reason, it is difficult to raise chicks, we recommend disposing of all birds and making a new start. It must be kept in mind that there are several factors which enter into the brooding problem aside from that of white diarrhea.

DISCUSSION

DR. BEACH: I might say, by way of explanation, that we have failed to find any positive-reacting hens from which we can not successfully brood the chicks. Now, we are looking for them, and if you have any we want them. In fact we want them any way. I may say when we have secured other tests they will be reported on later. We want to get as much data as we can from known-reacting hens, to check results further.

DR. L. W. GOSS: What breeds do you use, and at what time of the year were the chicks incubated?

DR. BEACH: The first bunch on which we reported were all White Leghorns but one; that was during the year 1924, and the chickens were brooded during the summer time, and the other bunch were all Rhode Islands but one, and the chickens were hatched in the spring, I believe the latter part of March or April. I know the question has been raised as to the breed of chickens. I can answer that so far as our results show, it does not make any difference, but our work has been so meager I would not care to make the statement.

DR. H. J. STAFSETH: Who cares for the chicks?

DR. BEACH: Mr. Lampman, one of our poultrymen, whose name is on the paper, has charge of that.

DR. STAFSETH: You never check up on how they are doing their work?

DR. BEACH: I may say during the last year I did part of it myself; we use the trap-nest, and the date of the egg and number of the hen was put on the large end of each egg. Occasionally two hens will get in the same nest. Where this happened the eggs were discarded.

DR. STAFSETH: What of the autopsy record of the hens tested?

DR. BEACH: We have the autopsy record on quite a number of the hens we used during the summer of 1924, and quite a few are alive.

DR. STAFSETH: I had reference to the condition of the ovaries.

DR. BEACH: I can look that up. I have not included that data in the paper, because there are a good many of the fowls alive at the present time; the macroscopic appearance is normal in part of the hens, but not in all.

DR. STAFSETH: I am particularly interested in this because Wisconsin seems to be the only place where these results are obtainable. You say that no one has conducted cultural studies upon this subject. I guess you were not present when we read our paper in Chicago, two years ago, but Dr. Hadley was there and he will remember the results we obtained in our agglutination studies.

Perhaps some of you know that the Belgians have a domestic breed of chickens called Coucou de Malines. These birds have been raised in Belgium for years and have been in great demand on the markets of London and Berlin, because of the fine quality of meat. At the time of the war the raising of Coucou de Malines was almost entirely discontinued, because people were unable to raise the chicks. The Director of the Veterinary Service at Brussels started an investigation of this problem and found that, in certain cases, eighty per cent of the hens reacted to the agglutination test. I do not remember exactly the year when they started—1920, I think—but since that time until now they have been conducting systematic tests on these birds and the result is that the Coucou de Malines is as much in demand as ever. It seems to me that these results should be obtainable anywhere. We know there are discrepancies, but there is not a single disease in which that is not the case.

I do not mean to discourage any of these investigations or discourage Dr. Beach, but I wish he would not speak of these results outside of veterinary meetings until we are better prepared to interpret these results. From Dr. Beach's remarks one would almost be tempted to conclude that in order to obtain good, livable chicks one would have to breed from bacillary-white-diarrhea-infected stock.

DR. F. B. HADLEY: I think it might be of interest to learn what happened to those chickens that you secured from Dr. Stafseth that had white diarrhea?

DR. STAFSETH: I know all about them. (Laughter.)

DR. BEACH: I may say in answer to Dr. Stafseth, that we have simply reported what we did and what we believe we found out. Possibly our results are not conclusive. As to reporting our results in meetings of veterinarians, I may say they never have been reported in any meeting except this and possibly a state meeting. There are some reasons, I presume, for Dr. Stafseth's statements, because letters have been written up there to our poultrymen, and I do not know what they are, but I presume they did not laud the tests too much. I can correct one erroneous idea that may have been left by Dr. Stafseth. Our efforts have been directed to the accuracy of the tests, and not to the comparison of the lesions with the test. In other words, to the way the individual hens vary at different times. If in the future our results are at variance with these, they will be reported just the same, there will be no holding back of records. I had not meant to bring in the names of men from other states, but I will have to in order to answer Dr. Stafseth's questions: One of the men at Cornell, whose findings do not agree with ours, has told me he was in search of some hens from a non-reacting flock, with which to conduct some investigation work. In one flock where, as far as he could determine, they had had no bad results in brooding chicks, he found that fifty per cent of the hens reacted. In the state of Kentucky, I was told by one of the poultrymen, I have not confirmed it by consulting the men in the Veterinary Department, that they tested some of their hens and got up to eighteen per cent reactions and have never had any trouble in brooding chicks from those hens. One man at Kansas told me that he sent away blood to three different laboratories, and as far as he was able to determine, the tests were all performed in acceptable manner, and that the results did not coincide. I might go on and tell you of a good many things. Now in our own minds we are not decided as to the meaning of the infection to the industry. We are leaving that for a future time. We are trying to report what we did and what we found.

DR. I. D. WILSON: Did you culture those hens?

DR. BEACH: We cultured all that we killed.

DR. F. R. BEAUDETTE: I should like to ask Dr. Beach to define a reactor.

DR. BEACH: That is a very proper question. A reactor, as we understand it, is one whose blood serum agglutinates the antigen in a dilution of one to

fifty or higher. The lowest dilution that we make is one to fifty; we possibly could have gone lower than that, but we did not.

DR. BEAUDETTE: What can you tell us of the turbidity of antigen?

DR. BEACH: Our antigen is comparatively light, about 0.9 on the McFarland nephelometer, tube No. 1. Our aim is to make an antigen as light as possible and still be visible when an agglutination has taken place.

DR. BEAUDETTE: Do you take serum from what you would consider a normal bird and determine the titre limit?

DR. BEACH: We have gone as low as one to ten, but not lower.

DR. BEAUDETTE: What do you consider the titre of the serum of a normal fowl, with the antigen you use?

DR. BEACH: I do not know. I have not determined that. I do not know what the normal titre is. I do not know whether if you add a very large amount whether it would agglutinate or not.

DR. BEAUDETTE: Do I understand you to say this first flock you investigated were all White Leghorns?

DR. BEACH: The flock was largely White Leghorns. We did test the whole flock. The birds in the experiment were largely White Leghorns.

DR. BEAUDETTE: I think it has been seen that brooding or management of baby chicks has quite an effect on the mortality, that is, if properly handled, the losses may be very light, but I wondered if you tested the progeny of your reacting hens.

DR. BEACH: We tested a large number of the progeny of these hens, and the percentage of reactors was considerably smaller. One hen I have tested probably twenty of her sons and daughters.

DR. BEAUDETTE: Of course, you understand a hen might have a localized infection, not necessarily in the ovary.

DR. BEACH: I presume this J-483 has. We hope to find out sometime.

DR. GOSS: Do you know that these reacting hens do not have typhoid infection?

DR. BEACH: No, I do not know that. They are simply reactors, but further than that we do not know I say the number of hens we have used is comparatively small, and we do not consider anything has been settled.

DR. FRANK HARE: Do you find anything in regard to seasonal fluctuation?

DR. BEACH: That is a question I can not answer. We tested these hens, this last group, every month, but it does not appear to show seasonal fluctuations. The fluctuation occurs at all times of the year, but might have been more pronounced certain seasons than others.

DR. STAFSETH: Holland reports a lot of chick trouble in their poultry industry, but up to this time have been isolating nothing. Tests have it there is some typhoid, but they did not do anything but make dilutions from eggs. Such an examination is not worth anything, because the egg may be infected with very large doses, and you would not find it except in very few eggs. Now, this thing of white diarrhea infection. We have it. Tests are on in our laboratories and on the farms. We had nothing to do with putting them on there. The poultrymen put them on. Farmers consider they had the highest percentage of production, high livability and fine birds by relying on this test; you can tell a scrub hen by looking at a scrub hen, but many fine looking hens have been found, when you have checked them up by agglutination tests, not to be such wonderful hens after all. You remember the experiments conducted at Wisconsin are conducted on small scale as compared with the tests for hatcheries we are conducting in Michigan; one of our towns has within it sixty hatcheries, and it is in these large flocks, where the chicks are handled on a commercial basis, that they obtain their best results. In other words, it may be a low grade infection, and the bird is able to come back to normal condition, but where the chicks are handled under commercial conditions, the mortality is greater, and that is the big thing, I consider. I believe the poultrymen in our communities should begin to check flocks. They admit they can not make the same thing work in commercial conditions that they do in college plants.

STUDIES IN THE DIAGNOSIS OF BACILLARY WHITE DIARRHEA*

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Since the investigations of Rettger[1] on the etiology of bacillary white diarrhea and the relation of mature infected fowls to the perpetuation of the disease in baby chicks, the problem of control has centered around the elimination of mature fowls harboring the infection. A practical procedure of detecting infected fowls through the utilization of the Widal test was suggested by Jones.[2] He applied the test and demonstrated its specificity as a diagnostic procedure in bacillary white diarrhea. The presence of specific agglutinins has also been used in the diagnosis of glanders, while in recent years the agglutination test for the detection of abortion disease in cattle has come into quite general use. Notwithstanding the fact that the agglutination test has been employed in many states in the diagnosis of bacillary white diarrhea, the value of this test has been frequently questioned. Because of the confusion in the minds of both veterinarians and poultrymen regarding the value of the test, a few flocks in Illinois were tested in 1922 with the hope of obtaining information regarding the merits of the test in preventing the development of bacillary white diarrhea in baby chicks.

It became apparent from these tests that the value of the agglutination test could not be appraised on the results obtained in a few flocks during a single season. In order to obtain information on this subject, and at the same time to assist the veterinarian and poultryman in the control of the disease, the use of the macroscopic agglutination test together with the removal of reacting fowls from infected flocks was started in a more extensive way in Illinois in 1923. The agglutination tests were conducted at the Experiment Station. Previous to being tested, flocks frequently had suffered a heavy loss in baby chicks. The examination of specimens from different localities in the State furnished convincing evidence of the widespread character of this malady. Chicks direct from commercial hatcheries, as well as from farm flocks, proved to be infected.

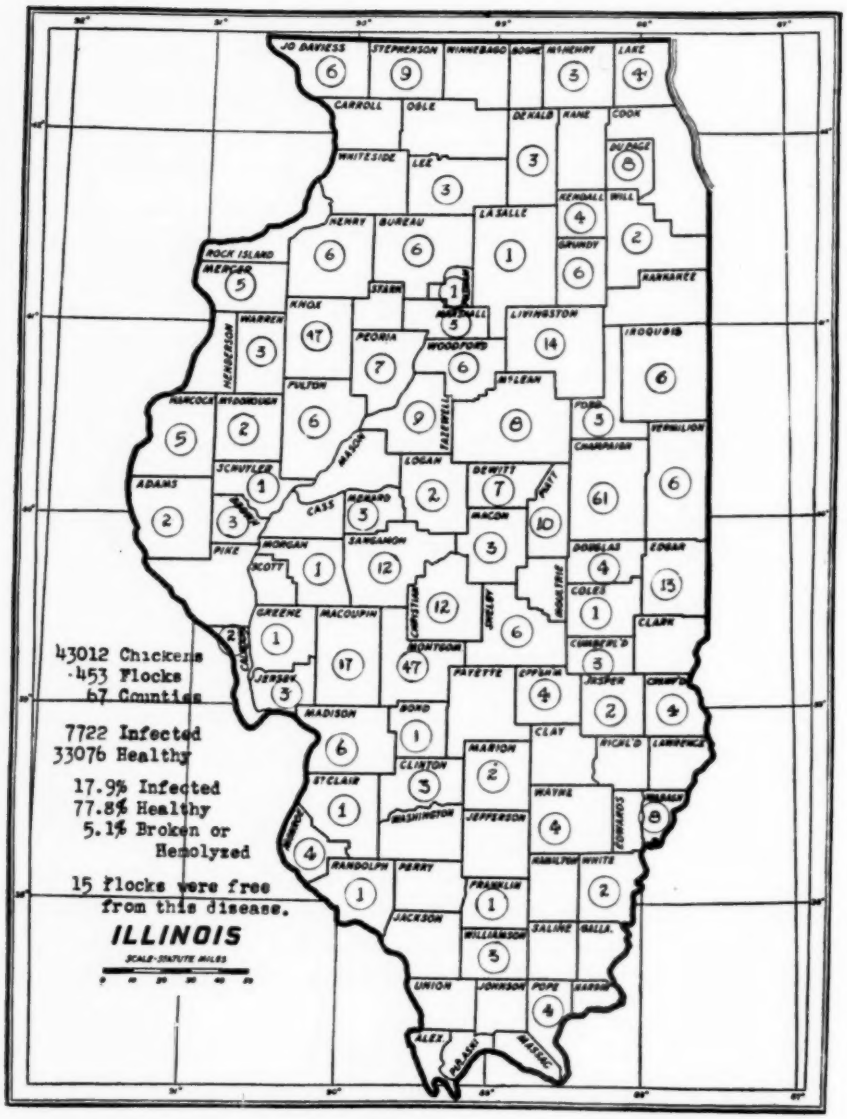
*Presented at the sixty-third annual meeting of the American Veterinary Medical Association, Lexington, Kentucky, August 17-20, 1926.

It was proposed in starting the testing of a large number of flocks to judge the value of the test by chick livability. Though it is conceded that healthy chicks may be hatched and reared from infected fowls, the potential danger of the disease being communicated to the chick as the result of infection through the egg seemed an important channel of perpetuating the infection. It was also apparent that if sanitary measures are neglected in tested flocks, such neglect might be responsible for the continuation of the disease and serious losses.

In this connection the live stock sanitary officials of Illinois undertook to supervise the regulatory phase of bacillary white diarrhea control by outlining tentative rules and regulations, under which flocks might ultimately be accredited free of bacillary white diarrhea. The essentials of sanitation, as drafted by the Chief Veterinarian of the State Department of Agriculture, are explained to the hatcheryman and flock-owner by practicing veterinarians at the time the blood samples are collected.

The activities of hatcherymen and veterinarians in pointing out necessary improvements in housing, as well as measures to be employed in maintaining flocks free from disease, together with the limitations of the test unaccompanied by sanitation, have proved helpful in this project. As the result of a single test some flock-owners have experienced decided improvement in chick livability, and become too enthusiastic regarding the value of the test, while other flock-owners have had little improvement in chick livability. These varying results present certain discrepancies which invite investigation.

Practitioners have collected the blood samples for a nominal fee of five cents each, and through the cooperation of owners have supervised the disinfection of premises and the removal of reacting fowls. The state regulations make the veterinary service obligatory, and through the local veterinarian leg-bands of reacting chickens are delivered to the Chief Veterinarian of the State. The Laboratory at the University has furnished vials and leg-bands, and dispatched the test. A fee of five cents per sample was charged for the agglutination test. After three years of testing at a centralized laboratory the value of official testing has been established, and a plan has been devised whereby the routine testing previously conducted at the University will be placed in the hands of practitioners under proper state supervision.



MAP 1. Agglutination tests for bacillary white diarrhea, during the year 1923-1924.

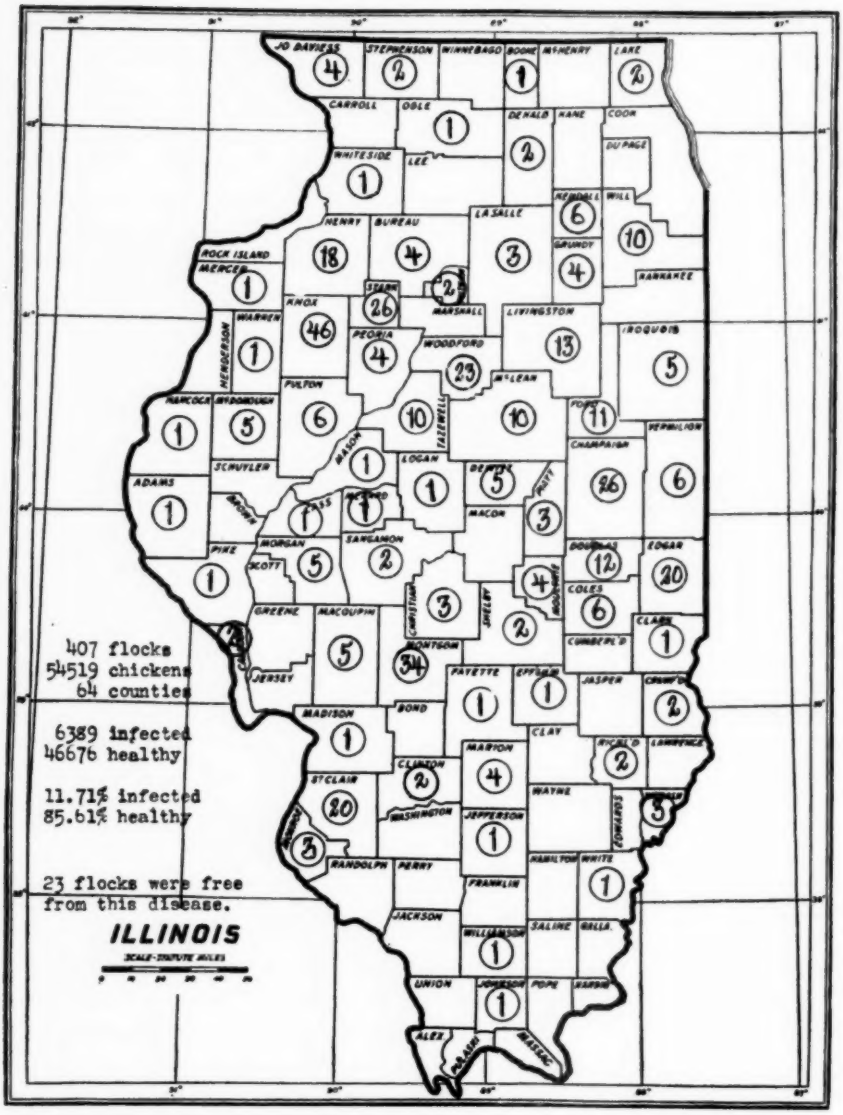
Scope of Work

A brief review of the work during the last three years may be of interest to practitioners engaged in similar work, or to those contemplating the establishment of a laboratory for work of this character. During this period more than a thousand pure-bred and grade farm flocks, including approximately 150,000 chickens, have been tested for bacillary white diarrhea at the University. (See geographic maps 1, 2 and 3.) Pure-bred farm flocks have been tested in practically every district of the State, and it is believed that the testing to date represents a mere beginning of a growing interest in the control of bacillary white diarrhea. Available laboratory facilities and help have been limiting factors in the number of chickens tested to date. Many flock-owners have requested assistance that could not be granted. It is believed, however, that with the work in the hands of careful practitioners, laboratories can be made more accessible to poultrymen over the State.

In Illinois the agglutination test for bacillary white diarrhea has been conducted during the winter months. A majority of the samples were tested during the months of November, December, January, February, March and April. Flock-owners have been urged to delay testing until 30 per cent or more of the flock were laying. One hundred ninety-seven practicing veterinarians have cooperated, receiving a total compensation of more than $7,500 for collecting the samples. This amount represents an average of $38.07 for each practitioner participating in the bacillary white diarrhea control work. The possibilities for service in the field of avian pathology and serology, for the active and alert practitioner, seem apparent.

Results of Testing

The actual results following the removal of reactors to the agglutination test are difficult to measure definitely. As judged by the livability of baby chicks, a standard that may be tentatively accepted, the agglutination test has displayed limitations that are well known to an audience of this character, as well as limitations that appear to be not so clearly understood. In our experience the routine of bleeding and leg-banding a large flock of fowls and labeling the vials may incur a certain percentage of error. Nothwithstanding this and other difficulties encountered, including obscure reactions, the agglutination test, supplemented by isolation of reactors, disinfection of premises, and clean



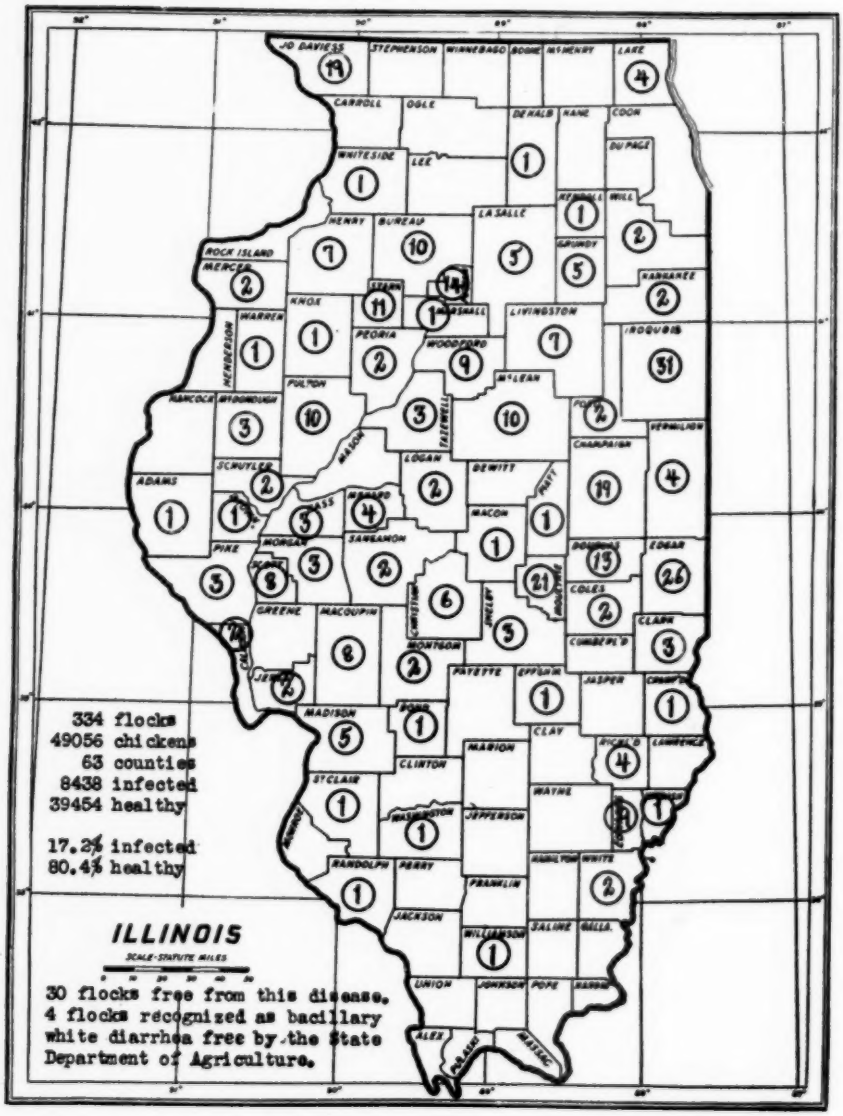
MAP 2. Agglutination tests for bacillary white diarrhea, during the year 1924-1925.

ground for baby chicks, appears to be a valuable aid in the control of the disease.

Results of the first year of testing may be judged in a practical way by data on the livability of chicks furnished by 240 of the 367 flock-owners. In all, 225, or 93.7 per cent, of the owners removed reactors according to the state rules, while 196, or 81.6 per cent, in addition to removing reactors, complied with the regulations in regard to disinfection of houses. One hundred eighty-seven, or 77.9 per cent, of the 240 flock-owners reported improvement in chick livability following one test, while 16, or 6.6 per cent, were unable to note any change in the livability of the baby chicks. The results in 14 flocks, or 5.8 per cent, were not so favorable. The fact that 146, or 60.8 per cent, of the owners reported no clinical evidence of the disease in their baby chicks was the most encouraging feature of the year's work. The baby chicks in these flocks in previous years had suffered from bacillary white diarrhea or a clinically indistinguishable disease. Sixteen owners, or 6.6 per cent, reported losses similar to those observed the previous year or years, and to this group were added the indefinite replies that expressed doubt, making a total of 12.4 per cent of the replies that were doubtful or distinctly unfavorable. Twenty-one owners, or 8.7 per cent, were noncomittal regarding the benefits of the test as judged by the health of the baby chicks, bringing the total of the unbenefited group to 21.1 per cent of the flocks tested. In 2 flocks, or 0.8 per cent, reactors were not removed and in 30, or 12.5 per cent, owners made no pretense at disinfection of houses.

Non-Reacting Infected Fowls

The mortality experienced in some flocks after testing was definitely associated with insanitary premises. Inferior poultry equipment and general surroundings made sanitation difficult of application where losses in baby chicks were experienced. Lack of sanitary measures, however, does not explain the discrepancies in all flocks. In some instances the purchase of infected chicks as well as the feeding of infertile eggs from hatcheries in the community may have served as sources of reinfection. In addition to unfavorable environmental and management factors, the potential danger of non-reacting infected fowls should be mentioned. From the standpoint of completely eradicating bacillary white diarrhea on the basis of the agglutination test, this is possibly the most serious obstacle which has been encountered



MAP 3. Agglutination tests for bacillary white diarrhea, during the yerr 1925-1926.

in our work, for the reason that as yet no method of detecting this type of infection has been definitely found. The potential danger of non-reacting infected fowls, along with other possible factors in perpetuating the disease, seems significant and worthy of further study in flocks where isolation of reactors and the application of sanitary measures have apparently not influenced the baby-chick loss. The results of the last two years of testing, as judged by chick livability, compare favorably with the results of the first year, and may be summarized by saying that a majority of the tested flocks have been benefited by the removal of reactors to the test supplemented by sanitary measures. In the main owners have been satisfied and often appear to be enthusiastic regarding the value of the test in controlling this disease.

Accredited Flocks

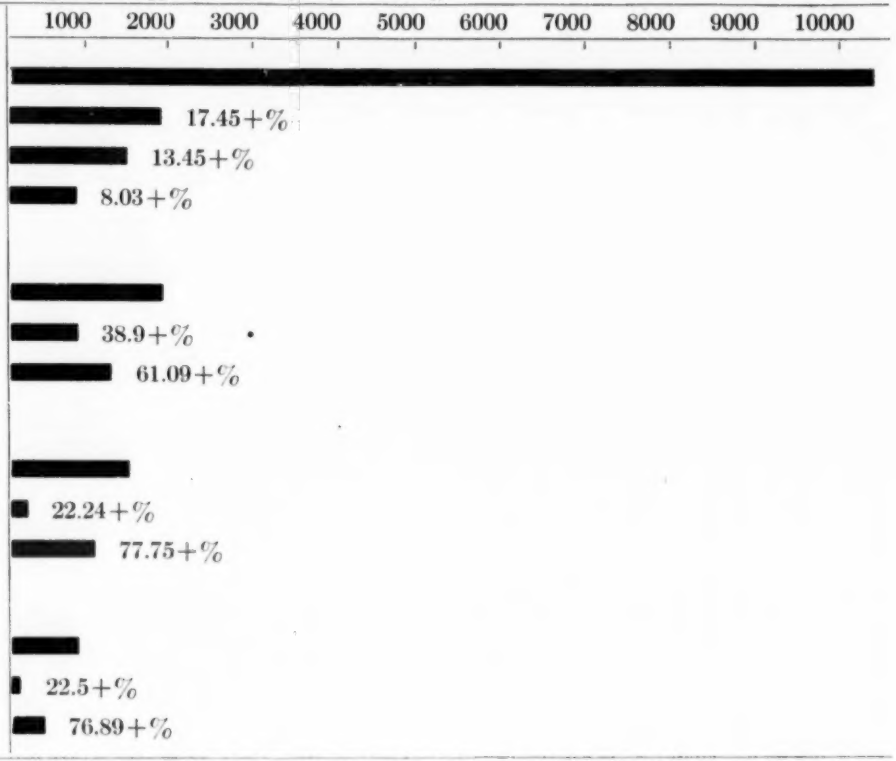
Notwithstanding factors which may retard progress, such as low antigenic strains in non-reacting fowls, measurable progress has been made by the State Department of Agriculture in the eradication of the disease on the basis of the agglutination test. This is indicated by the fact that four flocks were accredited as free from bacillary white diarrhea in 1926. In addition, 26 flocks passed one clean test. If these flocks are found free from the disease, as judged by the results of the agglutination test next year, they will, according to state rules, be eligible for official accreditation. In several other flocks the infection has been reduced to less than 5 per cent.

Different Dilutions in Agglutination Tests

In connection with the routine macroscopic agglutination tests an opportunity was provided to compare the reaction in different dilutions of serum and antigen. The results in using a composite antigen prepared from different strains seem to suggest that a low dilution may be desirable for diagnostic purposes. In 1923 and 1924, 10,327 samples were tested in dilutions of 1 to 10, 1 to 50, and 1 to 100. Agglutination in each of these dilutions was suggested as diagnostic by experienced serologists and, in order to select the dilutions most satisfactory with our antigen for the work, all were experimentally employed. One thousand, eight hundred two blood samples, or 17.45 per cent, agglutinated in a 1-to-10 dilution, while 1389, or 13.45 per cent, agglutinated in 1 to 50, and 830, or 8.03 per cent, agglutinated in 1 to 100. (See table I.)

TABLE I—*Comparative agglutination tests (1923-1924)*

BLOOD SAMPLES	NUMBER	
Total tested	10,327	
Positive 1 to 10	1,802	17.45+%
Positive 1 to 50	1,389	13.45+%
Positive 1 to 100	830	8.03+%
I		
Total positive 1 to 10	1,802	
Positive 1 to 10, negative 1 to 50, 1 to 100	701	38.9+%
Positive 1 to 10, 1 to 50, 1 to 100	1,101	61.09+%
II		
Total positive 1 to 50	1,389	
Positive 1 to 50, negative 1 to 10, 1 to 100	309	22.24+%
Positive 1 to 50, 1 to 10, 1 to 100	1,080	77.75+%
III		
Total positive 1 to 100	830	
Positive 1 to 100, negative 1 to 50, 1 to 10	187	22.5+%
Positive 1 to 100, 1 to 50, 1 to 10	643	76.89+%



In view of the results, it seemed apparent that with the conditions under which the dilutions were made and interpreted, the variation in the results encountered did not seem to be explained entirely on the basis of the human factor of error. A more careful comparison of the 1802 samples that reacted positively in 1 to 10 showed that 701 of this number, or 38.9 per cent, were negative in 1 to 50 and 1 to 100. Slated in another way, of the 1802 samples that gave a positive agglutination in 1 to 10, 1101, or 61.09 per cent, agglutinated in all three dilutions. Of the 1389 samples that gave a positive agglutination in 1 to 50, 309, or 22.24 per cent, failed to agglutinate in a 1-to-10 or 1-to-100 dilution, while 1080, or 77.75 per cent, agglutinated in all three dilutions. Of the 830 samples that agglutinated positively in a dilution of 1 to 100, 187, or 22.5 per cent, failed to agglutinate in 1 to 50 and 1 to 10, while 643, or 76.89 per cent, agreed in all three dilutions. The result of dilutions of 1 to 10, 1 to 50, and 1 to 100 prompted the omission of the 1-to-50 dilution, which seemed to add little diagnostic efficiency to the test.

In 1924-1925, 49,745 samples were tested in dilutions of 1 to 10 and 1 to 100. Of this total, 6,409, or 12.88 per cent, gave a positive agglutination in 1 to 10; 3,964, or 7.97 per cent, reacted positively in a dilution of 1 to 100 (see table II) and 2,451, or 38.24 per cent, of the 6409 samples that reacted positively in a dilution of 1 to 10 proved negative in a dilution of 1 to 100. Of the total number tested this represents a difference of 4.92 per cent. Six samples, or 0.15 per cent of the 3,964 samples that proved positive in a dilution of 1 to 100, failed to agglutinate in a dilution of 1 to 10. This number represents 0.012 per cent of the total. A comparison of the results of dilutions of 1 to 10 and 1 to 100 suggested that a dilution of 1 to 100 probably added but little efficiency in a routine diagnostic way to the dilution of 1 to 10, since only 6 samples out of 3,964 that reacted in 1 to 100 failed to agglutinate in a dilution of 1 to 10.

The danger of non-specific reactions in a dilution of 1 to 10 has been largely eliminated by a realization that one limiting factor in the value of the agglutination test may be traceable to infected fowls that fail to react, rather than the less serious factor, from the standpoint of disease control, of non-infected fowls reacting. In this connection it must be conceded that fowls infected with *E. sanguinarium* might give a positive reaction. Dilutions of 1 to 10 were compared with 1 to 20 on 4,040 samples. Nine hundred seventy-six, or 24.15 per cent, of the 4,040 samples

TABLE II—*Comparative agglutination tests (1924-1925)*

BLOOD SAMPLES	NUMBER	10000	20000	30000	40000	50000
Total tested	49,745					
Positive 1 to 10	6,409	12.88+%				
Positive 1 to 100	3,964	7.97+%				
Positive 1 to 10, negative 1 to 100	2,451	38.24+% of 6409 or 4.92+% of 49745				
Positive 1 to 100, negative 1 to 10	6	.15+% of 3964 or .012+% of 49745				

TABLE III—*Comparative agglutination tests (1925-1926)*

BLOOD SAMPLES	NUMBER	1000	2000	3000	4000
Total tested	4,040				
Positive 1 to 10 and 1 to 20	976	24.15+%			
Positive 1 to 10	810	20.04+%			
Positive 1 to 10, negative 1 to 20	164	4.05+%			
Positive 1 to 20, negative 1 to 10	2	.04+%			

reacted positively in a dilution of 1 to 10 and 1 to 20 (see table III). Eight hundred ten, or 20.04 per cent, proved positive in a dilution of 1 to 10, while 164, or 4.05 per cent, were positive in a dilution of 1 to 10 and negative in 1 to 20. Two, or .04 per cent, proved positive in a dilution of 1 to 20 and negative in 1 to 10. Thus little or no evidence was obtained to suggest that the agglutination test, as applied and interpreted with our antigen in the diagnosis of *Salmonella pullora* infection in mature fowls, is increased in efficiency for routine work by supplementing the 1-to-10 with higher dilutions. The results of the comparisons briefly described led to the adoption of the 1-to-10 dilution as first recommended to us by Doctors Craig and Whiting, of Purdue University. In view of the fact that the diagnostic dilutions in the agglutination test may be largely dependent on the sensitivity of the antigen, it is recognized that variations in antigens might easily influence the dilution to be employed in different laboratories.

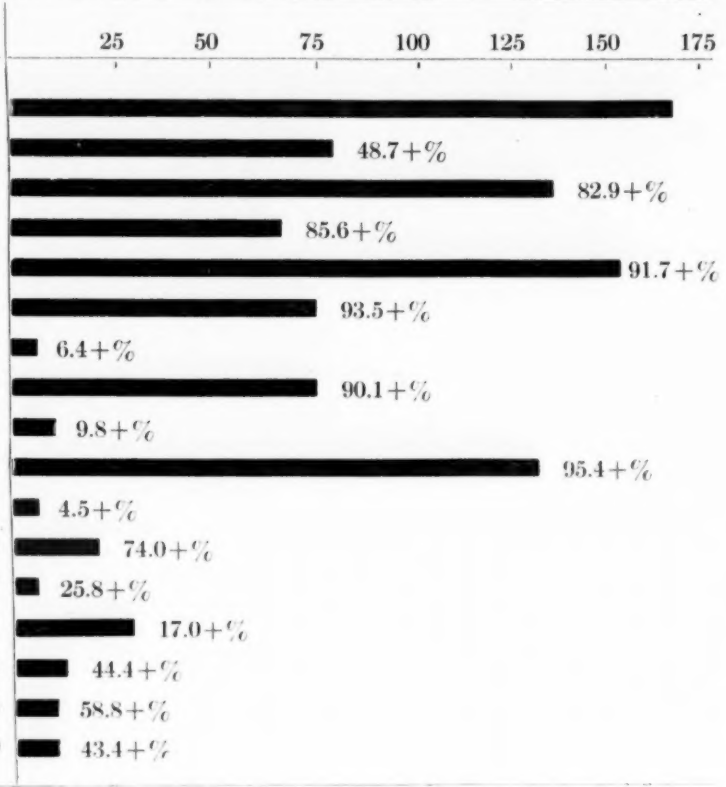
Pullorin Test

In connection with the routine application of the agglutination test, the pullorin or intradermal test, as first suggested by Ward and Gallagher,[3] as a possible means of diagnosing bacillary white diarrhea in mature fowls, was employed experimentally in several flocks. The comparative results of the agglutination and pullorin tests to be described in this paper are limited to 158 Barred Plymouth Rock and White Wyandotte chickens in pens 2, 3, 4, 5, 7 and 24, in the Experiment Station flock. As baby chicks, each group suffered a heavy mortality from bacillary white diarrhea. Following the first laying season in June, 1925, blood samples were drawn from each chicken for the agglutination test. The pullorin was then administered and as the experiments in which the chickens were employed by the Poultry Division were completed, the fowls were made available for autopsy.

Pullorin-Agglutination Results

The results of both the agglutination and pullorin tests suggested that the disease was rather prevalent among the chickens of each of the six pens. Two different lots of experimental pullorin were used, while the agglutination test consisted of two dilutions of 1 to 10 and 1 to 100. Agglutination in either dilution was recognized as positive to *Salmonella pullora* infection. In pens 2, 4 and 7, all the agglutination reactors were detected by the pullorin test, while in pen 5 only 57.8 per cent of the reactors to

TABLE IV—*Agglutination and pullorin tests in Experiment Station flock (1925)*



*17 Positive agglutination reactors in pen 3. †23 Positive pullorin reactors in pen 3.

the agglutination test reacted to the pullorin test. In this pen, 15 per cent more of the chickens reacted to the agglutination test than to the pullorin test. In the remaining five pens more chickens reacted to the pullorin test than to the agglutination test. Although discussion of the comparative results in each of the six pens would be of interest, the data are more accurately summarized on the basis of the total chickens in all pens. (See tables IV and IVa.)

TABLE IVa—*Agglutination and pullorin tests in experiment station flock (1925)*

CHICKENS	GROSS LESIONS	AGGLUTINATION	PULLORIN
12	+	0	0
61	+	0	+
2	0	+	+
64	+	+	+
8	+	+	0
4	0	0	+
3	0	+	0
4	0	0	0
158	145	77	131

In all, 77, or 48.7 per cent, reacted to the agglutination test, while 131, or 82.9 per cent, reacted to the pullorin test. The diagnostic accuracy of the two tests, as applied and interpreted, is not suggested in the number of fowls reacting to each test. It is interesting, however, to note that of the 77 chickens reacting to the agglutination test, 66, or 85.6 per cent, were detected by the pullorin. The variation in the results of the two tests represents a serious discrepancy which may be accounted for in part through one of several uncontrollable factors of error entering into comparisons of this character. In connection with the pullorin test the injection of the pullorin, the potency of the pullorin, and the standard of interpreting reactors might obviously influence results, while errors in the agglutination test might be traceable to numbering and labeling of blood samples and in the application and interpreation of the result. These imperceptible human factors of error may tend to reduce but not discredit the actual variation.

OVARIAN LESIONS AT AUTOPSY

At autopsy, 145 chickens, or 91.7 per cent, showed gross ovarian lesions. Macroscopically these lesions varied from a thickened, sacculated, discolored or congested ovarian capsule to markedly ill-shaped ovaries containing a dry, brownish-yellow content.

The ovaries of some chickens that were sacculated and ill-shaped contained a normal-appearing yolk. Seventy-two, or 93.5 per cent, of the 77 chickens reacting to the agglutination test showed gross pathologic lesions of the ovaries, while 125, or 95.4 per cent, of the 131 pullorin reactors showed gross ovarian lesions at autopsy. Five of the agglutination reactors, or 6.4 per cent, showed no gross lesions, while 6 of the pullorin reactors, or 4.5 per cent, failed to show ovarian lesions. In our limited experience absence of macroscopic ovarian lesions is not necessarily indicative of freedom from the disease. Stated in another way, non-reactors to both tests have yielded positive cultures from grossly infected ovaries, while positive bacteriologic evidence has also been obtained from non-reacting, no-lesion cases.

A more serious discrepancy was found in the fact that 73, or 90.1 per cent, of the chickens showing gross lesions failed to react to the agglutination test, and that 20, or 74.0 per cent, of 27 negative reactors to the pullorin test showed gross ovarian lesions. These results, however, may possibly be explained on the basis that pathologic changes in the ovaries are not in all cases related to *Salmonella pullora*.

The results encountered in these and other comparisons not included in this paper suggest that microörganisms other than *Salmonella pullora* may be isolated from gross pathologic ovaries of the domestic fowl and pigeon. The presence of *Salmonella pullora* infection on the basis of gross pathologic changes in the ovaries is thus regarded as a relative procedure and certainly not as a precise or accurate guide of the infection in each fowl. Furthermore, considerable importance should probably be attached to the fact that some non-reacting fowls have yielded positive cultures of *Salmonella pullora* upon bacteriologic examination of the ovaries. Such findings cannot be overlooked in appraising the cause of irregularities encountered in the diagnosis of bacillary white diarrhea in mature fowls from the standpoint of disease control. So far it appears that these strains may be a factor in perpetuating the disease in some tested flocks in which reactors have been isolated and premises maintained in a sanitary condition. The extent and significance of low antigenic strains in perpetuating the disease seems an important problem in correctly interpreting irrgularities encountered in the control of the disease.

Bacteriologic Findings

Routine work at the time these studies were conducted prevented making cultures from the ovaries of each chicken. At autopsy an incomplete bacteriologic examination was carried out on the 27 chickens in pen 3. In this group 17 chickens reacted to the agglutination test and 23 to the pullorin test. Fifteen, or 88.2 per cent, of the agglutination reactors in pen 3 were detected by pullorin. One culture from the ovary of each chicken was made on agar slants. All chickens in this pen showed gross pathologic lesions which varied in extent. The most extensively affected ovum of each fowl was cultured by piercing the ovarian capsule with a sterile platinum needle. Twelve of the 27, or 44.4 per cent, yielded *Salmonella pullora*. Ten, or 58.8 per cent, of 17 agglutination reactors yielded positive cultures, while 10, or 43.4 per cent, of the 23 pullorin reactors proved positive.

Summary

During the last three years the macroscopic agglutination test has been employed in diagnosing bacillary white diarrhea in mature fowls. The removal of reactors to the test in conjunction with sanitary measures appears to be valuable in the control of this disease. A majority of flocks tested have shown a high rate of chick livability.

Failure in reducing the loss in baby chicks from bacillary white diarrhea in some flocks may be traceable to insanitary premises, or to the purchase of infected day-old chicks or fowls infected with low antigenic strains that are not detected by the routine agglutination test.

As evidence of progress in bacillary white diarrhea control, the Chief Veterinarian of the State Department of Agriculture, after three years, has accredited four flocks as free from bacillary white diarrhea on the basis of two annual negative agglutination tests. Twenty-six flocks have passed one clean test, while the infection in other flocks has been noticeably reduced. In the Experiment Station flock comparative results of the agglutination and pullorin tests on a small number of chickens, followed by autopsy, suggests the possible value of pullorin in the diagnosis of this disease.

References

[1]Rettger, L. F.: Septicemia in young chickens. N. Y. Med. Jour., lxxi (1900), pp. 803-805.
[2]Jones, F. S.: The value of the macroscopic agglutination test in detecting fowls that are harboring *Bacterium pullorum*. Jour. Med. Res., xxvii (1913), pp. 481-495.
[3]Ward, A. R., & Gallagher, B. A.: An intradermal test for *Bacterium pullorum* infection in fowls. U. S. Dept. Agr. Bul. 517 (1917).

Discussion

Dr. H. J. Stafseth: You mention this disease in the ovaries; I suppose you have had the ovaries examined to determine what was there. A hen was sent to us for examination and I diagnosed the case as bacillary white diarrhea on macroscopic examination. Due to the fact that people in our state are rather reluctant in admitting that they have bacillary white diarrhea in their flocks, I subject all specimens, suspected of having this disease, to a careful bacteriological examination. In this case, I was surprised to find that there was no *Bacterium pullorum* in the ovary. On the other hand, I obtained pure culture of *Bact. avisepticum*. Some ovaries that we have examined were very bluish in color. We have obtained *Bacterium pullorum* from such ovaries as well as from the livers and hearts of the same birds. There are some ovaries that look as if they might have bacillary white diarrhea infection, but results of the bacteriological examinations show that they do not. It is possible that such changes may be the result of other causes. When a hen has been laying and becomes ill from any cause, the ovary undergoes retrogressive processes, which may bring on a macroscopic appearance suggestive of bacillary white diarrhea.

SYMBIOSIS AND DISEASE GERMS

A theory that may have an exceedingly important bearing on the cause of many obscure diseases has been advanced by Dr. Aldo Castellani, who is internationally known as an authority on tropical disease.

There is a condition among microorganisms known as symbiosis, which in spite of its formidable sound simply means a close association of two or more organisms in a kind of alliance like matrimony, with many of its benefits, but none of its drawbacks. Dr. Castellani believes that this state of symbiosis may be responsible for many symptoms and even the cause of some diseases not yet fully understood. "It seems certain," he says in a report to the American Medical Association, "that there are diseases caused by a true symbiosis or association of two organisms neither of which alone is capable of producing the malady."

He cites, as an example, common itch, the eruptions of which are not due to the mite which causes it, by burrowing under the skin, but to a pus-forming coccus that finds the skin irritated by the mite a particularly fertile field in which to increase and multiply. A similar condition maintains in the tropical malady, yaws, where the eruptions are likewise caused by an associated coccus and not the specific causative agent. Certain symptoms in severe cases of typhoid fever have been demonstrated, according to Dr. Castellani, to occur only in the presence of both the typhoid germ and another bacterium. Neither germ will produce the reaction alone.

—*Science.*

THE DIFFERENTIATION OF *BACT. PULLORUM* (RETTGER) AND *BACT. SANGUINARIUM* (MOORE)*

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In 1889 E. Klein[7] isolated an organism from chickens that died during an epidemic in Kent, England, which he called *Bact. gallinarum*. The description he gives of this organism in regard to morphology, staining and cultural characteristics, and inoculation experiments are very similar to that given by Moore[5] of an organism that he isolated from an epidemic among fowls in this country, in 1895, which he called *Bact. sanguinarium*, and which has since been considered to be the causative agent of fowl typhoid. Hadley,[5] in 1918, showed that these two organisms were identical.

In 1900 Rettger[9] isolated from chicks an organism which he later proved was the causative agent of bacillary white diarrhea. This organism was morphologically and culturally very similar to *Bact. sanguinarium* except that it produced gas in certain carbohydrate media, while the latter produced only acid. Also there appeared to be certain differences in the carbohydrates fermented by these two organisms.

In 1913 Jones[6] described an acute disease in adult fowls due to *Bact. pullorum*. This organism differed from that described by Rettger in that it did not produce gas in any carbohydrate, but in all other respects it appeared to be identical with it. However, there are no data given in Jones' article that would differentiate his organism from *Bact. sanguinarium*. Hadley[4] also reports infections in adult fowls due to this non-gas-producing type. Later work has shown these two types of organisms to be identical except in the matter of gas-production. The gas-producing type has become known as *Bact. pullorum* A and the non-gas-producing as *Bact. pullorum* B.

The differentiation of the non-gas-forming type of *Bact. pullorum* from *Bact. sanguinarium* is a problem that is very frequently met with in the routine laboratory diagnosis of poultry diseases. A great deal of work has been done in the differentiation of these organisms by carbohydrate fermentation, with the

*A thesis presented to the faculty of the Graduate School of Cornell University, in partial fulfillment of the requirements for the degree of Master of Science, June, 1925.

TABLE I—*Fermentation reactions—Bacterium pullorum A, Culture 1791*

CARBOHYDRATE	1ST DAY			2ND DAY			4TH DAY			6TH DAY			16TH DAY			26TH DAY			44TH DAY		
	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT
Dextrose	+ +	+ —	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —
Lactose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Sucrose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Maltose	— —	— —	— —	— —	— —	— —	— —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	+ —	+ —	+ —	+ —	+ —
Mannite	+ +	+ —	+ —	+ +	+ —	+ —	+ +	+ —	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ B	+ +	+ +	+ B
Dextrin	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —
Dulcit	— —	— —	— —	— —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —
Isodulcit	+ +	+ —	— —	+ +	+ +	+ —	+ +	+ +	+ —	— +	+ +	+ —	— +	+ +	+ —	— +	+ +	+ —	— +	+ +	+ B
Xylose	+ —	— —	— —	+ —	— —	— —	+ +	+ +	+ —	+ +	+ +	+ +	+ +	+ +	+ +	+ +	+ +	+ +	+ +	+ +	+ +
Salicin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Raffinose	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	+ —	— —
Inulin	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	+ —	+ —
Galactose	+ +	+ +	+ —	+ +	+ +	+ B	+ +	+ +	+ B	+ +	+ +	+ B	+ +	+ +	+ B	+ +	+ +	+ B	+ +	+ +	+ B
Arabinose	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —	+ +	+ +	+ —

+ + = acid and gas. + — = acid only. — — = negative. — + =gas only. + B = acid and bubble of gas.

result that *Bact. sanguinarium* is usually considered to be maltose-dextrin-dulcit-positive, while *Bact. pullorum* B fails to ferment these sugars.[2,3] Serologically it has been found that there is a very close relationship by the cross-agglutination of these organisms and that *Bact. pullorum* immune serum will agglutinate the sanguinarium organism about as well as it will the pullorum organism and vice versa.[3,10] Smith and Ten Broeck[11] state that, "toxin production is identical and differences in immunological relations have not been found."

A number of strains have recently been isolated from chicks in this laboratory that have failed to produce gas in the sugars which are ordinarily fermented by the pullorum organisms. This is unusual, as it generally has been found that the gas-producing type is the cause of infections in young chicks and the non-gas-producing strains are the etiological factor in adult infections. Also a number of these non-gas-producing strains have produced acid in maltose-extract bouillon on over-night incubation.

Thinking that the media might be at fault, several new lots were prepared and used with the same results. Other types of gas-producing organisms have produced gas in all lots regularly. Extract bouillon with the addition of approximately one per cent sugar has been used in the routine work but in a few cases infusion bouillon has been tried with the same results.

It was also noted that stock strains of *Bact. pullorum*, both of the A and B types, would produce acid in maltose-extract bouillon if the cultures were allowed to stand about the laboratory for some time. This, together with the fact that some of the freshly isolated non-gas-producing strains produced acid in maltose-extract bouillon on over-night incubation, indicated that these strains were either *Bact. sanguinarium*, or that maltose could not be used as a means of differentiation between this organism and *Bact. pullorum* B. However, none of the pullorum strains fermented dextrin, while all of the stock sanguinarium strains readily did so.

The fact that maltose is a rather unstable sugar and easily breaks down into dextrose was considered, but several lots of maltose were used with the same results. To prevent this breaking down, the maltose, and in fact all sugars, were autoclaved in ten per cent solution in distilled water and then pipetted into the sterile bouillon in sufficient quantity to make approximately a one per cent sugar solution.

TABLE II—*Fermentation reactions—Bacterium pullorum B, Culture 1343*

CARBOHYDRATE	1ST DAY			2ND DAY			4TH DAY			6TH DAY			16TH DAY			26TH DAY			44TH DAY		
	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT
Dextrose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Lactose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Sucrose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Maltose	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —
Mannite	+ —	+ —	— —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Dextrin	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —
Dulcit	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —
Isodulcit	+ —	+ —	— —	+ —	+ —	+ —	— —	+ —	+ —	— —	+ —	+ —	— —	+ —	+ —	— —	+ —	+ —	— —	+	+ —
Xylose	— —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	+ —	— —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Salicin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Raffinose	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —
Inulin	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —
Galactose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Arabinose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —

+ + = acid and gas. + — = acid only. — — = negative. — + = gas only.

These observations on the irregularities of these organisms showed that the present methods of differentiating them on carbohydrate fermentation were inadequate and this work was undertaken in the attempt to find some definite means of differentiation. The work naturally divided itself into:

1. Fermentation studies.
2. Serological studies.

Fermentation Studies

It has been shown by Doyle and Spray[12] that the pullorum organisms would ferment maltose quite readily in serum water. Broadhurst[1] brought out, in her work with streptococci, that the kind of media used had a marked effect on the fermentative power of these organisms and that the optimum nutrient medium for the organisms concerned should always be used in work of this character. She found that streptococci produced two or three times as much acid when grown in meat infusion as in meat-extract media. Jones[5] showed this again and also that the addition of a little blood-serum to infusion or extract bouillon markedly increased acid-production. This suggested that perhaps in a more favorable medium, such as serum-water, carbohydrates that remained unchanged in the ordinary infusion or extract bouillon might be attacked. In this work serum-water, infusion bouillon from meat, and extract bouillon were used.

Preparation of Media

The serum-water was prepared by adding ox serum to distilled water in the proportion of one part serum to three of water. One per cent Andrade's indicator was added to this and then it was tubed and autoclaved.

The infusion bouillon was prepared from meat (ground beef) in the ordinary way and then rendered sugar-free by spontaneous anaerobic fermentation. It was then titrated and the reaction adjusted to 0.2 per cent acid to phenolphthalein. One per cent Andrade's indicator was added and the bouillon autoclaved. Samples of the bouillon were tested for the presence of sugar in fermentation tubes with pure cultures of *Bact. coli* and found sugar-free.

The extract bouillon was prepared with 0.2 per cent meat extract, 1 per cent peptone, and 0.5 per cent NaCl. The reaction was adjusted to 0.2 per cent acid to phenolphthalein, 1 per cent Andrade's indicator was added and the bouillon autoclaved.

TABLE III—*Fermentation reactions—Bacterium sanguinarium (Moore)*

CARBOHYDRATE	1ST DAY			2ND DAY			4TH DAY			6TH DAY			16TH DAY			26TH DAY			44TH DAY		
	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT	SERUM	INFUSION	EXTRACT
Dextrose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Lactose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Sucrose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Maltose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	— —	+ —	+ —	— —	+ —	+ —
Mannite	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Dextrin	— —	— —	— —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	— —	+ —	+ —	— —	+ —	+ —
Dulcit	+ —	— —	— —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Isodulcit	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	— —	+ —	+ —	— —	+ —	+ —	— —	+ —	+ —	— —	— +	+ —
Xylose	+ —	+ —	— —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Salicin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Raffinose	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	+ —	+ —
Inulin	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	— —	— —	+ —	+ —	+ —
Galactose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Arabinose	+ —	— —	— —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —

+ + = acid and gas. + — = acid only. — — = negative. — + = gas only.

Fourteen carbohydrates were used. They were all put up separately in 10 per cent solution in distilled water, autoclaved, and then pipetted into the various sterile tubes of media in amounts to make approximately a 1 per cent solution.

Organisms Used

Most of the organisms were stock strains that had been carried in the laboratory for some time. Some recently isolated cultures of *Bact. pullorum* A were used because only one of the stock strains of that type would produce gas at this time in carbohydrate media. These strains had apparently lost their power of gas-production under continued artificial cultivation. Several lots of each type of medium and several lots of sugars were tried, always with the same results. Some of these cultures were incubated at 37°C. as long as one month.

History of Strains Used

Bact. sanguinarium (Moore) was obtained from Dr. F. R. Beaudette, of the New Jersey Agricultural Experiment Station, and is supposedly a sub-culture of the original strain isolated by Moore,[8] in 1895.

Bact. gallinarum (Klein) was also obtained from Dr. F. R. Beaudette and is supposedly a sub-culture of the original strain isolated by Klein,[7] in 1889.

Bact. sanguinarium (Smith) was a stock strain originally obtained from Dr. Theobold Smith.

Bact. sanguinarium is an old stock culture on which it was impossible to obtain any history.

Bact. sanguinarium (Taylor) was obtained from Dr. W. G. Taylor, previous to 1917. This strain apparently has lost all power of fermenting carbohydrates. Morphologically and in staining characteristics it appeared to be typical, but it consistently failed to ferment carbohydrates. All three types of media were tried and some of the tubes were incubated for as long as two months.

Pullorum B Strains

Culture 1364 was isolated June 5, 1924, from a dead chick received at the laboratory for diagnosis.

Culture 1128 was isolated Dec. 14, 1923, from the internal organs of a hen. This bird was sent into the laboratory with the history that thirty birds had died in a short period of time. This

organism produced acid in maltose and dextrose on isolation. Dextrin and dulcit were not tried.

Culture 1150 was isolated on Jan. 21, 1924, from the ova of a hen.

Culture 1343 was isolated May 28, 1924, from a baby chick.

Culture 1153 was isolated Jan. 22, 1925, from the diseased ova of a hen.

Pullorum A Strains

Culture 1791 was isolated April 2, 1925, from the liver of a baby chick.

Culture 1454 was isolated July 28, 1924 from the liver of a 2½-months-old chick.

Culture 1805 was isolated April 8, 1925, from the liver of a baby chick. This organism produced acid in maltose on over-night incubation when first isolated.

Culture 1822 was isolated April 14, 1925, from a baby chick.

Culture 1803 was isolated April 8, 1925, from a baby chick. It produced acid in maltose on over-night incubation when first isolated.

Fermentation of Carbohydrates

In the fermentation tests fourteen carbohydrates were used. The various strains were transferred daily from three to five days or more in serum-water or infusion bouillon to get them to growing vigorously. The carbohydrate medium was then inoculated from these cultures with Pasteur pipettes. Some of the tubes no doubt received a larger amount of inoculum than others and this may account for some of the delayed reactions during the first period of incubation. A seal was put into all tubes by pipetting melted vaseline into them. This formed a tight seal over the top of the medium and when gas was formed this seal was pushed up in the tube. Readings were made every day for two weeks, and then twice weekly up to forty-four days. Only a limited number of these readings are reported in the tables, as the slight changes that occurred from day to day after the first few days did not warrant the making of the large table that would be necessary to include all these data.*

Summary of Fermentation Tests

Dextrose: This sugar was fermented about equally as well by all strains. The pullorum A strains produced gas, though there

*Complete tables of fermentation tests used in this work are included in the 1925-26 report of the New York State Veterinary College, now in preparation.

was considerable variation in the amount of gas-production. Strains 1822 and 1803 never produced more than a bubble of gas during the whole period of observation, and strains 1791 and 1805 produced gas in serum-water and infusion bouillon but not in extract bouillon, though 1805 did show a bubble of gas in the extract bouillon near the close of the period.

Lactose: All strains failed to ferment lactose.

Sucrose: All strains were negative in this sugar though in some cases a faint pink coloration in serum-water was observed after a number of days of incubation.

TABLE IV—*Fermentation reactions in serum water*

Carbohydrate	Pullorum A Strains					Pullorum B Strains					Sanguinarium Strains			
	1791	1822	1803	1805	1454	1153	1128	1364	1150	1343	Moore	Smith	Kfein	B. Sang.
Dextrose	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Lactose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Sucrose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Maltose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Mannite	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Dextrin	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Dulcit	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Isodulcit	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Xylose	+ —	+ +	+ —	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Salicin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Raffinose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Inulin	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Galactose	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Arabinose	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —

+ + = acid and gas. — — = negative. + — = acid only. — + = gas only.
+ B = acid and bubble of gas.

Maltose: The sanguinarium strains showed acid-formation from this sugar in all types of medium after the first days of incubation. Both pullorum A and B types produced acid in serum-water the first day, but were negative in the infusion and extract bouillon until about the fortieth day, when they produced acid in these also. The sanguinarium strains, with the exception of "Smith," became alkaline in serum-water after about the eighth day.

Mannite: All strains fermented this substance practically the same as dextrose. Gas-production was variable with the different strains of pullorum A and in the different types of media.

Dextrin: All strains of sanguinarium fermented dextrin in all three types of media and, with the exception of "Smith," became alkaline in serum-water after about eight days of incubation. This alkalinity was not observed in the infusion and extract bouillon. The pullorum strains produced acid in serum-water from the first day, if they were invigorated by transferring daily for several days in bouillon or serum-water. If not previously invigorated they did not produce acid until after four or five weeks of incubation. Work which has not yet been completed indicates that they will ferment dextrin in infusion and extract

TABLE V—*Fermentation reactions in infusion bouillon*

Carbohydrate	Pullorum A Strains					Pullorum B Strains					Sanguinarium Strains			
	1791	1822	1803	1805	1454	1153	1128	1364	1150	1343	Moore	Smith	Klein	B. Sang.
Dextrose	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Lactose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Sucrose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Maltose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Mannite	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Dextrin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	+ —	+ —	+ —	+ —
Dulcit	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	+ —	+ —	+ —	+ —
Isodulcit	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Xylose	+ +	+ +	+ —	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Salicin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Raffinose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Inulin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Galactose	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Arabinose	+ +	+ +	+ +	+ +	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —

+ + = acid and gas. — — = negative. + — = acid only. — + = gas only.
+ B = acid and bubble of gas.

bouillon also, if they are repeatedly transferred into these media containing 1 per cent dextrin.

Dulcit: The action of all strains on dulcit was practically identical with their action on dextrin. This substance was fermented by both sanguinarium and pullorum but the sanguinarium strains fermented it somewhat more readily than the pullorum strains.

Isodulcit: All strains fermented isodulcit about equally well and there was a tendency for a return to alkalinity after an intital period of acidity, especially in serum-water.

Xylose: All strains fermented xylose about equally well, though not so readily as in the case of mannite and dextrose.

Salicin: All strains failed to ferment salicin.

Raffinose: All strains fermented raffinose in serum-water from the first day but were negative in infusion and extract bouillon until about the fortieth day, when acidity was noted in the sanguinarium strains and to a smaller extent in the pullorum strains.

Inulin: The action on inulin of all strains was practically identical with that on raffinose.

TABLE VI—*Fermentation reactions in extract bouillon*

Carbohydrate	Pullorum A Strains					Pullorum B Strains					Sanguinarium Strains			
	1791	1822	1803	1805	1454	1153	1128	1364	1150	1343	Moore	Smith	Klein	B. Sang.
Dextrose	+ —	+ B	+ B	+ B	+ +	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Lactose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Sucrose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Maltose	+ —	— —	+ —	+ —	+ —	— —	+ —	+ —	? —	— —	+ —	+ —	+ —	+ —
Mannite	+ B	+ B	+ —	+ B	+ B	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Dextrin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	+ —	+ —	+ —	+ —
Dulcit	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	+ —	+ —	+ —	+ —
Isodulcit	+ +	+ +	+ B	+ —	+ B	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Xylose	+ +	+ +	+ —	+ B	+ B	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Salicin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Raffinose	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Inulin	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Galactose	+ B	+ B	+ B	+ —	+ B	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —
Arabinose	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —	+ —

+ + = acid and gas. — — = negative. + — = acid only. — + = gas only.
+ B = acid and bubble of gas.

Galactose: All strains fermented galactose readily from the first day, in all types of media.

Arabinose: All strains fermented arabinose readily from the first day, in all types of media.

Summary of Action in Serum-Water

The action of all strains of sanguinarium and pullorum was practically identical in serum-water containing the various carbohydrates (with the exception of the gas-production of the pullorum A strains). As a rule more gas was produced in serum-water than any other medium.

Summary of Action in Infusion Bouillon

In infusion bouillon the action of the sanguinarium and pullorum strains was the same in all the carbohydrates except maltose, dextrin and dulcit. The sanguinarium strains fermented these carbohydrates readily, while the pullorum strains fermented maltose only after about forty days of incubation and did not ferment dextrin and dulcit as long as observed. However, some of the pullorum strains fermented maltose in this medium on over-night incubation when first isolated and all the strains fermented dextrin and dulcit after they had been kept growing vigorously in them by continued daily transfers for a number of days.

Table VII—*Cross-agglutination reactions*

Serum	Antigen	Serum Dilutions								
		1/40	1/80	1/160	1/320	1/640	1/1280	1/2560	1/5120	1/10240
Sanguinarium	Sanguinarium	C	C	C	C	C	C	C	++	+
Sanguinarium	Pullorum B	C	C	C	C	C	C	C	++	—
Sanguinarium	Pullorum A	C	C	C	C	C	C	+++	++	—
Pullorum B	Pullorum B	C	C	C	C	C	C	C	C	+++
Pullorum B	Pullorum A	C	C	C	C	C	C	C	C	++
Pullorum B	Sanguinarium	C	C	C	C	C	C	C	++	—
Pullorum A	Pullorum A	C	C	C	C	C	C	C	C	C
Pullorum A	Pullorum B	C	C	C	C	C	C	C	C	+
Pullorum A	Sanguinarium	C	C	C	C	C	C	C	++	—

C or ++++ equals complete agglutination.

Summary of Action in Extract Bouillon

All strains fermented the various carbohydrates in this medium in about the same manner as in the infusion bouillon, though gas-production by the pullorum A strains was less marked.

Serological Proceedings

In this work two normal rabbits were immunized to each of the following strains:

1. *Bact. sanguinarium* (Moore)
2. *Bact. pullorum* B (culture 1343)
3. *Bact. pullorum* A (culture 1791)

Each rabbit was injected subcutaneously twice weekly for four weeks with the respective cultures. The antigen used for injection was made by growing the organism on plain-agar slants for

twenty-four hours, washing off the growth in physiological saline solution so as to obtain a heavy suspension and then heating it for one hour at 60°C. to kill the organisms.

At the end of four weeks the rabbits were bled and the agglutinin titre of the serum found to be around 1-10,000. Agglutinations with the homologous antigens, cross-agglutination and absorption tests were then carried out as shown in the tables.

In the absorption tests each respective type of immune serum was absorbed separately with each of the three strains of organisms. The antigen used was prepared by growing on plain-agar slants for twenty-four hours, washing off in physiological saline solution, and then centrifuging the organisms into the bottom of

TABLE VIII—*Absorbed sera set with sanguidarium antigen*

		SERUM DILUTIONS								
SERUM	ABSORBED BY	1/40	1/80	1/160	1/320	1/640	1/1280	1/2560	1/5120	1/10240
Sanguinarium	.....	C	C	C	C	C	C	C	++	+
Pullorum B	Sanguinarium	—	—	—	—	—	—	—	—	—
Pullorum A	Sanguinarium	—	—	—	—	—	—	—	—	—
Sanguinarium	Sanguinarium	—	—	—	—	—	—	—	—	—
Pullorum B	Pullorum B	—	—	—	—	—	—	—	—	—
Sanguinarium	Pullorum B	++	+	—	—	—	—	—	—	—
Pullorum A	Pullorum B	—	—	—	—	—	—	—	—	—
Pullorum B	Pullorum A	—	—	—	—	—	—	—	—	—
Sanguinarium	Pullorum A	++	—	—	—	—	—	—	—	—
Pullorum A	Pullorum A	—	—	—	—	—	—	—	—	—

C or ++++ equals complete agglutination.

the tube and draining off the supernatant liquid. The immune serum was then added to the organisms in the tubes in the approximate proportion of three parts of a 1-10 dilution of serum in physiological saline to one part of organisms. The organisms were then thoroughly mixed with the serum and the tubes placed in the incubator at 37.5°C. for three hours. They were then taken out and kept in the ice-box over night. In the morning the organisms were centrifuged out and agglutinations were set, using every combination of serum and antigen that it was possible to make.

Inspection of tables VII, VIII, IX and X will show that:

1. In the cross-agglutination tests the sanguinarium-immune serum agglutinated the pullorum organisms as well as did its own identical antigen, and vice versa.

2. In the absorption test it was found that the sanguinarium agglutinins were practically completely absorbed by both the pullorum A and B types of organisms and vice versa, viz, both the pullorum A and B types of immune serum were completely absorbed by the sanguinarium organisms. The pullorum A and B types of organisms each completely absorbed the agglutinins specific for the other.

Summary

This work has been directed towards the differentiation of *Bact. sanguinarium* from *Bact. pullorum*. It was naturally divided into fermentative and serological studies. The results may be summarized as follows:

TABLE IX—*Absorbed sera set with pullorum A antigen*

Serum	Absorbed by	Serum Dilutions								
		1/40	1/80	1/160	1/320	1/640	1/1280	1/2560	1/5120	1/10240
Pullorum A	.....	C	C	C	C	C	C	C	C	C
Pullorum B	Sanguinarium	—	—	—	—	—	—	—	—	—
Pullorum A	Sanguinarium	—	—	—	—	—	—	—	—	—
Sanguinarium	Sanguinarium	—	—	—	—	—	—	—	—	—
Pullorum B	Pullorum B	—	—	—	—	—	—	—	—	—
Sanguinarium	Pullorum B	—	—	—	—	—	—	—	—	—
Pullorum A	Pullorum B	—	—	—	—	—	—	—	—	—
Pullorum B	Pullorum A	—	—	—	—	—	—	—	—	—
Sanguinarium	Pullorum A	—	—	—	—	—	—	—	—	—
Pullorum A	Pullorum A	—	—	—	—	—	—	—	—	—

C or ++++ equals complete agglutination.

1. Fermentation of carbohydrates in serum-water: The same carbohydrates were attacked by all strains in this medium. The pullorum A strains differed from the others by gas-production. The only difference between pullorum B and sanguinarium is in the rate of fermentation of dextrin and dulcit, sanguinarium fermenting these more rapidly than pullorum.

2. Fermentation of carbohydrates in infusion and extract media. In these media the fermentations of pullorum B and sanguinarium were identical, except in maltose, dextrin and dulcit. These were fermented readily by sanguinarium but with difficulty or not at all by pullorum. Maltose was fermented by pullorum very slowly and the other two substances were not fermented at all unless the culture had been grown in their constant presence, with frequent transfers at short intervals. Pullorum A fermented

the same carbohydrates as pullorum B, but with gas-formation from one or more of them. The gas-formation was erratic.

3. Sera of rabbits immunized to representatives of one species agglutinated the other two species to the same titre as the homologous organism. This had previously been shown by Hadley[3] and Rettger.[10]

4. When sera immune to each of the three types were placed in contact with organisms of the other two types practically complete absorption of the agglutinins occurred.

Discussion and Conclusions

From the data submitted in this paper it seems permissible to draw the following conclusions:

Table X—*Absorbed sera set with pullorum B antigen*

Serum	Absorbed by	Serum Dilutions								
		1/40	1/80	1/160	1/320	1/640	1/1280	1/2560	1/5120	1/10240
Pullorum B	.....	C	C	C	C	C	C	C	C	+++
Pullorum B	Sanguinarium	C	+	—	—	—	—	—	—	—
Pullorum A	Sanguinarium	—	—	—	—	—	—	—	—	—
Sanguinarium	Sanguinarium	—	—	—	—	—	—	—	—	—
Pullorum B	Pullorum B	—	—	—	—	—	—	—	—	—
Sanguinarium	Pullorum B	—	—	—	—	—	—	—	—	—
Pullorum A	Pullorum B	—	—	—	—	—	—	—	—	—
Pullorum B	Pullorum A	C	++	—	—	—	—	—	—	—
Sanguinarium	Pullorum A	++	—	—	—	—	—	—	—	—
Pullorum A	Pullorum A	—	—	—	—	—	—	—	—	—

C or +++ equals complete agglutination.

1. *Bact. pullorum*, alpha type, may be differentiated from *Bact. pullorum*, beta type, on the basis of gas-formation, providing a suitable nutrient basic medium is used for the tests. As has been pointed out by Hadley,[13] ordinary extract broth is not a suitable medium for this purpose. Contrary to the findings of Hadley[3] and Goldberg[2], certain strains of pullorum which were aerogenic when freshly isolated have lost their power of gas-formation after varying periods of artificial cultivation.

2. By the agglutination and agglutinin-absorption tests it is not possible to differentiate the two types of *Bact. pullorum* from each other or from *Bact. sanguinarium*. By fermentation tests it is possible to make such a differentiation between the strains studied when infusion or extract medium is used as the substrate for the carbohydrates, but when serum-water is used

as the basic medium the characteristic fermentative differences disappear.* All of the sanguinarium strains grew much better on ordinary media than the pullorum strains. Therefore, the thought is suggested that ordinary broth is not a very favorable medium for fermentation tests with *Bact. pullorum*, and if such is the case differences in fermentative results in this medium should not be accepted as demonstrating a specific taxonomic difference between this organism and another for which the medium was better suited.

3. This work shows that there are but little cultural differences between *Bact. pullorum* and *Bact. sanguinarium*. In fact, aside from somewhat greater growth-vigor on the part of the latter, no characteristic cultural differences were found. We are not prepared to state as yet that these organisms are one and the same species, but at least this work has lent strength to the suggestion of Hadley[3] that "*Bact. pullorum* may be *Bact. sanguinarium* in the making."

ACKNOWLEDGMENT

The writer wishes to acknowledge his indebtedness to Dr. W. A. Hagan, of the Department of Bacteriology, for many valuable suggestions and criticisms.

REFERENCES

[1]Broadhurst: Jour. Inf. Dis., xiii (1913), p. 404.
[2]Goldberg: Rpt. N. Y. State Vet. Coll., 1915-16, p. 283.
[3]Hadley: R. I. Exp. Sta. Bul. 174 (1918).
[4]Hadley: R. I. Exp. Sta. Bul. 172 (1917).
[5]Jones: Jour, Exp. Med., xxxii (1920), p. 273.
[6]Jones: Jour. Med. Res., xxvii (1913), p. 471.
[7]Klein: Cent. f. Bakt., v (1889), p. 689.
[8]Moore: 12th-13th Ann. Rpts. U. S. Dept. Agr., p. 185.
[9]Rettger: Jour. Med. Res., xviii (1908), n. s. 13, p. 277.
[10]Rettger & Koser: Jour. Med. Res., xxxv (1917), p. 443.
[11]Smith & Ten Broeck: Jour. Med. Res., xxxi (1915), n. s. 26, p. 547
[12]Spray & Doyle: Jour. Inf. Dis., xxviii (1921), p. 43.
[13]Hadley: Jour. Bact., iv (1919), p. 65.

VISITORS AT THE JOURNAL OFFICE

During the past two months, the JOURNAL office has been favored with visits from quite a number of veterinarians. Among those who paid the Secretary-Editor their respects are the following: Dr. E. A. Watson, Ottawa, Ont.; Dr. C. D. McGilvray, Guelph, Ont.; Dr. C. E. Salsbery, Kansas City, Mo.; Dr. J. W. G. Hansen, Greenville, Mich.; Dr. Ward Giltner, East Lansing, Mich.; Dr. B. J. Killham, Lansing, Mich.; Drs. H. T. Carpenter, G. Floyd Ewalt, Warren P. S. Hall, Joseph Hawkins, John Hoberg, P. V. Howard, E. E. Patterson, E. P. Schaffter and A. S. Schlingman, all of Detroit, Mich.

*This acid-production might be considered by some to be due to the presence of dextrose in the serum, but when sugars were not added to the serum-water there was no indication of acid-production during one month of incubation.

AN ENZOOTIC SALPINGITIS OF PULLETS, WITH SPECIAL REFERENCE TO *SALMONELLA PULLORA* INFECTION

By HUBERT BUNYEA, *Associate Veterinarian*

Pathological Division, U. S. Bureau of Animal Industry, Washington, D. C.

Although the pathogenic role of *Salmonella pullora* in connection with the occurrence of bacillary white diarrhea of baby chicks has long been recognized, the generally accepted belief that, in the system of the carrier hen this infection is with few exceptions dormant in the ovary, does not seem to be well founded.

Numerous instances of acute fatal bacteremic infection among hens from which *S. pullora* alone is recovered come under the observation of the writer. The duration of noticeable symptoms ranges from three or four days to two weeks. Appetite diminishes or entirely ceases, and the birds sit with drooped wings, unkempt plumage and hanging head. They move with reluctance and extreme difficulty. The more rapid cases may display cyanosis of the comb and wattles, but are less likely to manifest white diarrhea than those of more prolonged duration.

Autopsy reveals a more or less generalized inflammatory condition of the visceral organs. A caseous or fibrinous exudate may be present among the convolutions of the intestine as a product of peritoneal infection. Frequently this material has the characteristic appearance of yolk substance, liberated by the previous rupturing of a degenerated yolk-body, infected with *S. pullora*, into the body-cavity and giving rise to an acute bacteremic infection with the organism involved.

Upon inspection of the ovary, darkened, shriveled or cystic lobules may be seen as evidence of typical *S. pullora* infection.

The organism may be recovered with much regularity from the ovary, as well as from the heart-blood and body parenchymata of these cases. Our observations do not indicate, however, that the disease spreads rapidly through the adult flock, but point rather to the hypothesis that the infection, long dormant in the ovary, may be suddenly fanned into a flame of virulence in the individual, perhaps because of that individual's lowered

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resistance. The repeated occurrence of the condition within a flock may be understood on the grounds of a common infected parentage or of early exposure to the germ, with an interval of latent infection during the adolescent period.

The peak of the infection in the form of an enzootic salpingitis is reached during the height of the egg-production among infected pullets. It is at this time that heavy-laying birds begin to experience most severely the strain of egg-production as they do not feel it during any other period of life. At this time there occur in these birds symptoms some of which are quite frequently confused with the common vent gleet of breeding hens. The virgin state of the pullets in many cases, however, promptly eliminates the suspicion of that disease and as promptly hints at a possible history of inherent white diarrhea infection. The general flock condition appears healthy and thrifty, but from time to time individuals have difficulty in laying, or even experience rupture of the vent while attempting to lay. Other cases exhibit hemorrhages from the vent without apparent reason. The presence of the blood attracts other pullets, which proceed to peck at and virtually eviscerate the unfortunate victim. Strangely, many of the birds thus attacked offer no resistance but, on the contrary, are given to the practice of lacerating their own vents. The quite common occurrence of leucorrhea and white diarrhea among the affected pullets tends to establish a swollen, inflamed and soiled condition of the vent which likewise attracts the feathered associates to acts of cannibalism.

Considerable variation obtains as to the postmortem findings of the cases brought under our observation, but these in general are such as to indicate a bacteremic or septicemic course of infection. There are sometimes limited pneumonic areas in one or both lungs, serous or fibrinous pericardial exudate in moderate amount, and possibly circumscribed areas of whitish deposit underlying the epicardium and having the appearance of hyalin degeneration.

A greater or lesser quantity of watery exudate may be found in the body-cavity, depending upon the incidence and duration of peritonitis. In some instances an inflammatory pseudomembrane covers the liver. Alterations in the character of the yolk-bodies may range from gangrenous to cystic degeneration. In several of the cases autopsied, these alterations noted in the ovary were the only macroscopic evidences of the disease as

regards the internal structures. A creamy leucorrhea, possibly blood-streaked, however, is to be observed in many cases.

Pure cultures of *S. pullora* may usually be recovered from the heart-blood and various internal organs, such as the liver, spleen, ovary and various sections of the lumen of the oviduct. The diseased portions of the ovary almost invariably yield a heavy growth of the organism. The rupture of infected yolks in the body-cavity may therefore be regarded as contributory to the frequent occurrence of primary peritoneal infection in these cases.

Selective localization of the inflammation in the ovary or oviduct may also in large measure account for the frequent observance of blood in the eggs (resulting from hemorrhages in the anterior part of the oviduct), blood-smeared shells (from inflammatory or traumatic dilatation hemorrhages in the posterior part of the oviduct or at the cloaca), or soft-shelled eggs (from lack of function of diseased shell-glands).

The occasional finding of strong, offensively smelling eggs seems to be the earliest evidence of the presence of this type of infection in a flock. Sporadic instances of white diarrhea and cloacitis are soon thereafter observed, which tend to the soiling and pasting of the posterior plumage, and the irritation of the contiguous skin. Occasional cannibalistic attacks will be perpetrated upon a diseased individual, incited by the conspicuous inflammatory state of the external genitals and their surroundings. As the disease begins to assume the proportions of an enzootic, this pernicious practice increases to an alarming extent.

Control of the disease at this juncture may be facilitated somewhat by the timely application of the intradermic and serological tests for *S. pullora* infection. Reactors should be isolated in small groups, and visibly affected birds, whether reactors or not, should be placed in special hospital quarters for rest and local treatment. Not too much significance should be attached to the results of the tests, however, except as emergency measures in the summary isolation of possible incipient cases. The writer does not regard the present diagnostic tests for *S. pullora* infection in hens as sufficiently discriminative for the selection of safe breeding hens. The present popular acceptance of these methods, and their exploitation for advertising purposes and as the basis of official certifications is as unfortunate as it is misguided.

Therefore, it is questionable whether it would be as good an expedient to undertake to weed out a very heavy percentage of infection or else to dispose of such a flock entirely, disinfect the premises, and start again with new stock from an unimpeachable source. Certainly no flock of poultry having been exposed to this enzootic should be employed subsequently for breeding purposes, at least until the most exacting evidence has been obtained that the disease has spent itself. What constitutes satisfactory evidence in this premise is, we believe, a problem in serology yet to be fully solved.

Table I records various observations made upon a group of pullets obtained from an outbreak of enzootic salpingitis due to *S. pullora* infection. The intradermic test was made with pullorin, a biologic similar to tuberculin, but prepared from *S. pullora* for intradermic diagnostic testing. The antigens for the agglutination tests consisted of suspensions of *S. pullora* of specific hen origin and specific chick origin respectively. Attention is called to the fact that the sera of these fowls exhibited a slightly higher sensitivity for the hen antigen than for the chick antigen in most instances, namely, 502, 507, 513, 530, 545, 555, 563, 579 (first test), 582 and 593 (second test). However it is interesting to note that this relative sensitivity is reversed in the second test of pullet 579.

The atypical reactions produced by the intradermic test applied on the 73rd day may be due partially to the fact that the pullorin employed was old and probably deterioriated. The reaction of fowls 502, 530, 545 and 593 to one or both of the tests, despite the failure to recover *S. pullora* from any of these cases, may signify the presence of evanescent allergic properties surviving the disappearance of the actual infection in the ovary.

Upon postmortem examination, hen 513 revealed the following:

The carcass was emaciated.

Whitish areas in subepicardium resembling hyalin deposits; liver, spleen and kidneys swollen; ceca hard and impacted with cheesy, blood-stained material.

The ovary contained yolk-bodies undergoing gangrenous necrosis, and cultures made from these yielded *S. pullora*.

S. pullora recovered from liver.

Upon postmortem examination, hen 563 was found to have been severely mutilated by cannibalistic assaults by the other birds in the pen. Her ovary was undergoing gangrenous necrosis;

TABLE I—*Allergic and serological reactions of fowls selected from an outbreak of enzootic salpingitis due to Salmonella pullora infection*

LEG-BAND NUMBERS	AGGLUTINATION TEST WITH ANTIGENS PREPARED FROM HEN ORGANISMS AND CHICK ORGANISMS RESPECTIVELY								INTRA-DERMIC REACTION 73RD DAY	REMARKS
	AT 32ND DAY				AT 45TH DAY					
	HEN ANTIGEN		CHICK ANTIGEN		HEN ANTIGEN		CHICK ANTIGEN			
	1 TO 50	1 TO 100	1 TO 50	1 TO 100	1 TO 50	1 TO 100	1 TO 50	1 TO 100		
502	+	+	+	?	+	+	+	+		Died on 70th day. No pathogens recovered
504	+	+	+	+	+	+	+	+	Slight	Killed on 76th day. Part of ovary degenerated. *S. pullora* recovered
507	+	+	+	?	?	?	—	?	Neg.	Killed on 76th day. Some lobes of ovary degenerated. *S. pullora* recovered
509	—	—	—	—	—	—	—	—	Neg.	Killed on 76th day. Ovary apparently normal. *S. pullora* not recovered.
513	+	+	?	?						Died on 32nd day. Ovary lesions. *S. pullora* recovered
530	+	?	?	?	+	+	?	—	Slight	Killed on 76th day. Ovary apparently normal. *S. pullora* not recovered
545	?	?	?	?	+	?	?	?	Very Slight	Killed on 76th day. Ovary degenerated. No pathogens. *S. pullora* not recovered
555	+	+	?	?	+	+	+	+	Neg.	Killed on 76th day. Part of ovary degenerated. *S. pullora* recovered
563	+	+	?	?						Died on 36th day. Ovary degenerated. *S. pullora* recovered
579	+	+	?	?	?	?	+	+	Slight	Killed on 76th day. Ovary degenerated. *S. pullora* recovered
582	+	+	?	?	+	+	+	+	Neg.	Killed on 76th day. Some lobes of ovary degenerated. *S. pullora* recovered
593	Bad Serum		Bad Serum		+	+	+	?	Neg.	Killed on 76th day. Ovary degenerated. No organism recovered

S. pullora was isolated therefrom in pure culture. No other pathological alterations were observed.

Hen 502 died on the 70th day, much emaciated. There were evidences of chronic diarrhea. The breast bone was soft and crooked, suggesting malnutrition and prolonged recumbence. The ovary was small and non-functioning. No pathogens were recovered from the heart-blood, liver or ovary.

A detailed autopsy report of the nine birds killed on the 76th day would not be of particular interest. However, the following findings are offered in summary:

Fowls 504 and 582 presented cardiac lesions suggestive of a cooked heart, with pericardial adhesions. The latter also demonstrated a pseudomembranous covering on the liver.

In fowls 504, 507, 545, 555, 579 and 582, degenerated ovary lobules of varying size were observed, but at the same time the production of apparently normal yolk-bodies was going on in all cases.

Cultures made from the liver and oviducts in these nine cases were negative except for the presence of a few colonies of *Staphylococcus aureus* in the liver of fowl 504, and *B. coli communior* in the liver of fowl 545. Thus it would seem that in case of a survival of the bird from an attack of salpingitis, the infection reverts to the dormant type, and again becomes localized in the ovary.

Control bird 509 remained negative to all tests and upon autopsy at the 76th day of its association with infected birds showed neither lesions nor pathogenic organisms present.

This, as far as it goes, is evidence favoring the assumption that *S. pullora* infection of hens is not actively contagious within the adult flock.

Summary and Conclusions

Salmonella pullora infection in adult hens and pullets may assume the character of a bacteremia, with primary lesions of peritonitis.

In its enzootic form the infection may bring about a salpingitis among heavy-laying pullets.

Salpingitis is manifested by offensive eggs, blood-spotted eggs, blood-smeared shells, soft-shelled eggs, cloacitis, white diarrhea and the practice of cannibalism within the flock.

Isolation and local treatment tend to convalescence, when the

infection may recede, in the course of 2½ months, to its favorite habitat, the ovary.

Complete disappearance of *Salmonella pullora* infection from the surviving bird occasionally occurs in that period.

Incipient cases may often be detected by the intradermic and agglutination tests.

Agglutinating fluids made with strains of *Salmonella pullora* from hens produce more sensitive reactions than those of baby-chick origin, when tested against the serum of infected hens.

Salpingitis appears to result from activation of latent inherent infection in the individual.

It is not readily disseminated among adult birds.

COD-LIVER OIL FOR CHICKENS

Hens given vitamin A in addition to their regular diet not only hatch more chicks, but are healthier themselves and lay bigger and better eggs. Dr. Arthur D. Holmes, of Boston, told of the effect of feeding vitamin-rich cod-liver oil to domestic fowls, at a meeting of the American Chemical Society, at Philadelphia, on September 10, 1926. Rhode Island Red pullets were given doses of cod-liver oil each day and as a result Dr. Holmes found that they laid more eggs. The eggs themselves were larger than usual and their fertility was greater. Fewer eggs contained objectionable blood-spots. The greater number and size of the eggs did not make nervous wrecks of the laying hens. On the contrary they showed increased vitality and did not lose weight during the tests. They had a greater resistance to diseases, for fewer of the vitamin-fed hens died than those on the normal diet alone, according to a note in *Science*.

RECOGNITION

In a pamphlet recently issued by the Medical Committee of the University of Pennsylvania Fund, devoted to the development of a modern medical group at that institution, the founding of the Veterinary School, in 1884, is mentioned as one of the steps in the progress made up to the the present time and in a historical review by the Provost, in the same publication, the name of the late Leonard Pearson, former Dean of the Veterinary School, is listed along with those of Wistar, Physick, Leidy, Wood and others, whose "illustrious names" have "graced" the record of the institution.

A MORE REFINED METHOD FOR OBTAINING BLOOD FROM FOWLS FOR SEROLOGIC WORK*

By H. M. MARTIN *and* J. F. OLNEY

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The technic most commonly used at the present time for obtaining blood from fowls is the so-called "nicking method." This method is nothing more than the pricking or nicking of the ulnar vein, in the region of the radiohumeral articulation, and collecting the blood in a small vial or test-tube as it flows from the wound.

This means of obtaining blood (the nicking method) is somewhat crude, and for this reason the authors have searched for a more refined method.

The technic which the writers have adopted may have been described before, but for the benefit of those interested in the collecting of blood samples from chickens, we deemed it advisable to describe our method of obtaining blood from fowls for serologic work.

The technic used by the writers may be designated as the "aspiration method," and the following equipment is necessary for the operation:

Sterilized 2-cc Record syringes.
Sterilized 21-gauge needles (1½ inches in length).
Sterile, labeled, 2-dram homeopathic vials.
Phenolized physiologic salt solution. (This solution is prepared by adding 0.85 gram of C. P. sodium chlorid and 0.5 gram of absolute phenol per 100 cc of distilled water.)
Two cups for the phenolized physiologic salt solution.
Box or barrel to serve as an operating-table.

PERSONNEL REQUIRED FOR THE OPERATION

Like in all other methods of blood-collection, the organization and adequacy of personnel is the most important factor if the operation is to be done speedily and with the minimum of inconvenience.

No less than one operator and one assistant should attempt this method of bleeding; but in order to bleed large numbers of birds within a short space of time the operator should have four assistants (one to catch the birds, one to record the number of the fowl on the vial and to present the vial for the blood, one to

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hold the bird for the operator, and the fourth assistant for rinsing the syringes). Another assistant for holding birds for the operation will permit even larger numbers of samples to be taken within a given time.

Method of Holding the Bird

In holding the fowl, the assistant should stand facing the operator, and the bird should be presented with its breast toward the

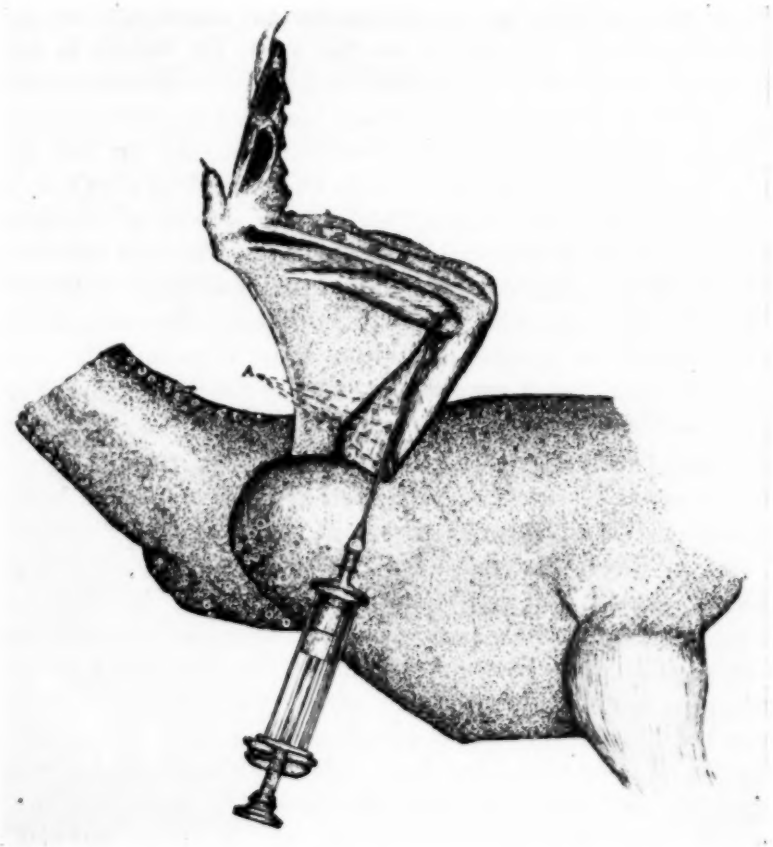

Fig. 1. Method of puncturing vein. A, row of stiff shaft feathers.

operator. The top wing is turned toward the dorsum, as illustrated in figure 1. The feet should be held in the left hand and stretched backward, while the right hand holds the wing, body, and head firm on the table. The index finger of the right hand should be kept free in order to lay forward a row of stiff shaft-feathers (A, fig. 1), which covers the field of operation.

The Vein and Its Location

The vein from which the blood is obtained is the humeral, and it lies in the loose fascia, between the biceps and deltoid muscles of the inner side of the wing in the humeral region (see fig. 1).

Puncture of the Vein

A 21-gauge needle, attached to the syringe, is introduced into the vein by directing its point toward the radiohumeral articulation, as illustrated in fig. 1. After sufficient blood (not less than one cc) has been aspirated from the vein, the needle is withdrawn and the blood is introduced into a two-dram homeopathic vial. Immediately after the syringe has been emptied it should be rinsed three times with the phenolized physiologic salt solution. Two rinsings should be made from the first cup and one from the second. The rinsing fluid should always be discharged into a receptacle provided for this purpose. The vial is immediately placed in a slanting position and this position is maintained until the blood has completely coagulated. The container is then placed in an upright position in order to permit the serum to collect in the free space at the bottom of the vessel, from which it can readily be removed by means of a pipette.

In regard to the advantage of the aspiration method over the nicking method, the writers find that it permits the aseptic collection of samples, and therefore provides better material for use in the laboratory. By this technic one always has a sufficient quantity of serum for a biologic test. Another point in favor of this operation is the speed with which it can be accomplished. The writers have been able to bleed as many as three birds plus per minute in flocks where the work was properly organized; for example, 95 blood samples were taken in 30 minutes. In one of the first flocks where the work was fairly well organized, 125 specimens were obtained in 90 minutes, and in the last lot of birds the writers obtained 240 blood samples in 80 minutes.

A record was kept on the bleeding of 1427 birds from 9 different lots, and the time required for obtaining these specimens was 10 hours and 56 minutes, or an average of 2.17+ birds per minute.

This technic was also used by other workers with an equal degree of speed.

This method should appeal particularly to the veterinarian, as superior to the sloppy, nicking technic so frequently used by

amateurs, which is not uncommonly responsible for contaminated samples and for labels so soiled as to render them useless.

In conclusion it might be said that this method, like most new ideas, will be objected to by some workers before they have thoroughly acquainted themselves with the technic required for bleeding fowls by this means, but the writers hope that any potential critic will suspend judgment until he has acquired skill by taking a few hundred samples.

DR. HAYES PROMOTED AGAIN

Dr. John J. Hayes has been promoted to the position of assistant general superintendent of Armour and Company. In this position Dr. Hayes will have general supervision over plant operations of Armour and Company in New York, Jersey City, Milwaukee, Indianapolis, Denver and Spokane. According to a biographical sketch published in the December number of the *Armour Magazine*, Dr. Hayes got his first experience in a packing-house in 1901, as a veterinary inspector in the employ of the Bureau of Animal Industry. In this capacity he was stationed in packing-plants in Chicago and New York until 1912, when he was placed in charge of sanitary conditions at all New York slaughterhouses by the Manhattan Inspection Association. In 1917 he joined the New York Butchers Dressed Meat Company as assistant superintendent. His wide experience in government inspection work was responsible for his transfer to Chicago, where he worked out of the General Superintendent's department. In this capacity he had occasion to visit all Armour plants. In 1925 he was again transferred to New York as assistant general superintendent, with supervision over all eastern plants. He remained in this position until his recent assignment as assistant general superintendent of Armour and Company.

DR. JOHN J. HAYES

OBSERVATIONS ON THE SPECIES OF INTESTINAL PARASITES OF POULTRY

By J. H. RIETZ, *Columbus, Ohio*

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This report is preliminary, the number of premises from which poultry have been examined being only one-half the final total of the problem. Also, the actual determination of species is quite incomplete at this time. However, certain phases of the work have progressed sufficiently, we think, to be of some interest to the profession.

SOURCE OF MATERIAL

The poultry received by the Department of Pathology of the College of Veterinary Medicine, Ohio State University, for postmortem examination, from September 12 to November 30, 1926, constituted the source of material from which this report is made.

One hundred fourteen chickens, originating on fifty premises, located in widely separated sections of the State, have been examined postmortem. Of the total number of chickens examined, only twelve were found free from parasites, as shown by our examination.

The condition in ninety-four of the birds was diagnosed as some form of parasitic disease, leaving a total of twenty birds primarily affected with diseases other than parasitic.

TECHNIC OF EXAMINATION

The technic employed in the postmortem examination of the birds is that in general use, excepting that the intestinal tract and its contents are subjected to a very careful examination with low- and high-power lenses. The intestinal tract is opened and all contents placed on a watch-glass. The split intestine is spread out, mucous membrane upward, and examined with a dissecting microscope, after which the adhering mucus and bowel contents are carefully washed off and the washings examined with the use of a binocular dissecting microscope. The washed intestinal tract is again examined for closely attached and very small parasites.

The intestinal contents are diluted with water, spread in thin layers and examined with the aid of the microscope. A technic

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of this character is necessary to avoid overlooking many and often quite heavy infestations with the small nematodes and cestodes.

Representative specimens of the parasites have been collected and preserved for study from all the premises and from nearly all the individual birds found infested.

Ascaris Lineata

Of the fifty premises from which one hundred fourteen chickens were examined, the large intestinal roundworms were found on twelve, involving fifteen of the birds examined.

A study of the specimen collected and comparison with the description of this parasite, as outlined by Schwarz,[1] seems to indicate that all are *Ascaris lineata*. However, further study and checking may show other species to be represented.

Class Cestodae

Under this class is placed the flat, segmented, intestinal parasites. The work of determining the genera and species under this heading has not been advanced sufficiently to report further than the class.

Of the fifty premises from which one hundred fourteen chickens have been examined, cestodes were found on twenty-nine, involving forty-five of the individuals examined. Five of the infested birds were dead upon arrival at the laboratory, consequently no symptoms were noted. Thirty-six showed some form of incoordination (leg weakness, lameness, paralysis) in gait. Twenty-six of these birds showed parasites of a type that are microscopic or visible only with the aid of magnification.

A preliminary examination of these microscopic types of cestodes seems to indicate that more than one and probably several species are represented.

Genus Capillaria

To this genus belong parasites whose bodies are capillary, mouth parts simple, esophagus long and usually increasing posteriorly. *Male:* Anus terminal, spicules surrounded by a sheath. *Female:* Vulva near termination of esophagus, eggs lemon-shaped, with operculum at each pole.

In the birds examined, the parasites belonging to this genus were more often found in the anterior portion of the intestinal tract. However, in the more heavily infested birds, specimens were found from the pylorus to the rectum. The parasites are

usually found directly in contact with the mucous membrane, lying under the heavy covering of catarrhal exudate found in most of the birds infested with these parasites.

Of the fifty premises from which one hundred fourteen chickens were examined, *Capillaria* sp. were found on fifteen, involving forty of the individuals examined. Of the forty individuals involved, eleven failed to reveal the presence of other parasites.

The literature covering this genus in the United States seems, so far as I can find, to be confined to two reports of the parasite, these having been found in poultry in Pennsylvania.

The work of determining the species of these parasites is only begun but, from a preliminary survey and measurements, it appears that probably more than one species is represented.

From a survey of the infested premises, the economic importance of this genus in Ohio can no longer be doubted.

Two pigeons were received at the laboratory for examination, one of which showed a heavy infestation with *Capillaria* sp.

Hetarakis Vesicularis

The cecal worms were found on nineteen premises, involving thirty-nine of the individuals examined.

These parasites were usually found in and confined to the ceca. However, in a few of the more heavily infested birds they were found throughout the length of the intestinal tract.

Coccidia

Coccidia were found in four birds originating on three of the premises. These were adult birds.

Genus Acuaria

Gizzard-worms were found in two birds originating on two of the premises.

Treatment for Capillaria sp.: Flock-owners are always vitally interested in the treatment, consequently when *Capillaria* sp. was diagnosed, we were unable to give any authentic information regarding methods of removal of these parasites. Since the beginning of this work twenty-seven birds have been experimentally treated after first establishing positive proof of infestation by fecal examination. These birds were destroyed for examination after a period of time following treatment.

Three birds were treated with kamala, one receiving kamala (one gram) alone, and two receiving kamala (one gram) and soda (one gram), with the result that all three birds showed a

heavy infestation with capillaria on postmortem. Apparently no benefit was derived from the use of kamala in the removal of the capillaria.

Three birds were treated with a mixture of turpentine (10 cc) and linseed oil (10 cc), with the result that two birds showed a heavy and one a slight infestation with capillaria on postmortem. Apparently little if any benefit was derived from the use of this mixture in the removal of the capillaria.

Seven birds were treated with areca nut, three receiving areca nut (fifteen grains) alone, and four receiving areca nut (fifteen grains) and soda (fifteen grains), with the result that two birds showed a heavy, three a slight and two no capillaria infestation on postmortem. Apparently some slight benefit was derived from the use of areca nut in the removal of the capillaria.

Carbon tetrachlorid was administered to fourteen birds. The dosage varied from 1 cc to 3 cc for adult birds, and in some individuals the 1-cc dose was repeated. The results from the treatment with carbon tetrachlorid were quite satisfactory, as the birds either showed no parasites or only three or four on postmortem. The few parasites not removed in a few birds were found around the pylorus.

There was apparently no advantage in giving the larger doses. One cubic centimeter was apparently as effective as a 3-cc dose. However, the best results were obtained from a 1-cc dose, repeated. It is suggested that the second dose be given about the seventh day following the first treatment.

One flock in which a severe loss had been sustained from capillaria infestation was treated with carbon tetrachlorid. One cc of the drug was given to each adult bird, the same dose being repeated on the seventh day following, with the result that losses from capillaria infestation have entirely ceased since treatment.

REFERENCE

Schwartz, Benj.: Jour. Agr. Res., xxx (1925), 8, pp. 763-772.

Here is an epitaph that was recently discovered on an old tombstone near Wetumpka, Alabama:

HERE LIES THE BODY OF SOLOMON PEAS,
UNDER THE DAISIES AND UNDER THE TREES.
PEAS IS NOT HERE—ONLY THE POD,
PEAS SHELLED OUT; WENT HOME TO GOD.

AN APPLICATION OF THE RAPID-METHOD AGGLUTINATION TEST TO THE DIAGNOSIS OF BACILLARY WHITE DIARRHEA INFECTION

By R. A. Runnells, C. J. Coon, H. Farley *and* F. Thorp

Department of Zoology and Animal Pathology
Virginia Polytechnic Institute
Blacksburg, Va.

Quite recently Huddleson and Carlson,[1] of the Michigan Agricultural Experiment Station, reported a rapid method for performing the agglutination test in the serum diagnosis of Bang's abortion disease in cattle. The senior author of the report here presented has had an opportunity to observe Huddleson give two demonstrations of this method of conducting the agglutination test and believes that an application of it can be made to the diagnosis of bacillary white diarrhea infection in adult fowls.

At this laboratory the rapid method of testing has been run along with the slow method on the sera of about 5000 birds. The results obtained with the rapid method at first did not agree in every case with those secured with the slow method. However, the disagreements even then were less frequent than the disagreements which are often encountered when the testing methods of different laboratories are compared upon the same samples. It was finally discovered that the principal cause of the disagreements was due to a variance in the serum-antigen dilutions used in the two methods under comparison. This variance occurred because McFarland's nephelometer was used in standardizing the turbidity of the antigen in the slow method, whereas Gates' nephelometer was used in the rapid method. It was discovered that the density of an antigen adjusted to a reading of 4 mm. on Gates' nephelometer varied considerably in the number of microörganisms per cubic centimeter, when the readings were made by different workers in the laboratroy or even when several readings were made by the same worker. This discrepancy in the number of microörganisms per cubic centimeter was so great that no very accurate comparison between the rapid and slow methods was possible when equivalent serum-antigen dilutions were necessary. As a result of this,

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Gates' nephelometer is not used for determining the density of the antigen now. McFarland's nephelometer is used in standardizing the antigens for both methods. Briefly the technic employed in the comparative tests is as follows:

Preparation of Antigen

Rapid method: One strain of *Bacterium pullorum* is grown on nutrient agar (pH 7.5) for 48 to 72 hours, washed off with a very small amount of a 12 per cent solution of sodium chlorid containing .5 per cent phenol, filtered through glass wool to remove clumps of bacteria and of media and adjusted so that its turbidity is 50 times greater than tube .75 of McFarland's nephelometer.

Slow method: The technic is the same as for the rapid method except that the 48-to-72-hour growth of the microörganism is washed off with an .85 per cent solution of sodium chlorid containing .5 per cent phenol, and adjusted to a turbidity of .75 by McFarland's nephelometer, using a physiological saline solution containing .2 per cent phenol for making the dilution.

Setting Up Tests

Rapid method: The tests are run on glass, ruled off in inch squares. The glass forms the top of a box in which is a frosted electric-light bulb that furnishes light and heat. The interior of the box is painted black. Two serum-antigen dilutions are used for each sample. The amount of antigen in each case is .02 cc. This amount of the concentrated antigen is equivalent to 1 cc of the antigen diluted to correspond to tube .75 of McFarland's nephelometer. Since this is the amount and turbidity of the antigen employed in the slow method, the two tests are placed on the same basis as regards antigen. The serum used is in .02-cc and .01-cc amounts. Therefore, the serum-antigen dilutions are equivalent to 1-50 and 1-100 in the slow method. The serum and antigen are placed a short distance apart in the squares and are mixed thoroughly with a tooth-pick. With positive sera agglutination usually takes place immediately. Occasionally a serum-antigen mixture is found that requires nearly five minutes for complete flocculation to occur. When this kind occurs the reaction can be hastened by agitation with a tooth pick.

Slow method: The tests are run in small Wassermann tubes, employing 1 cc of the antigen (turbidity .75 by McFarland's nephelometer) in each of two tubes. To the first is added .02 cc

of serum and to the second .01 cc. This gives dilutions of 1-50 and 1-100 as used in the rapid method.

Advantages of the Rapid Method

A diagnosis can be made very quickly with the rapid method. In most instances when a positive serum is mixed with the antigen the reaction occurs immediately.

Since the tests are run on glass there is an economy of Wassermann tubes and the necessary washing and sterilizing encountered in their use.

The rapid method requires the same amount of antigen and serum as does the slow method. About the same amount of time is used in preparing the antigen and making up the serum-antigen dilutions.

The rapid method is more adaptable to field use than the slow method. It can be run at hatcheries which secure their eggs from rather large communities. Blood samples that are collected in the forenoon may be tested immediately after noon, and the reactors may be removed the same day. In state-wide and area campaigns for controlling bacillary white diarrhea this method has an advantage over the slow method because the inspector who collects the blood samples may also remove the reactors before he leaves the community. With the slow method the inspector may have moved to a distant hatchery before the results of the test are known.

REFERENCE

[1]Huddleson, I. F., & Carlson, E. R.: A rapid method for performing the agglutination test in the serum diagnosis of Bang's abortion disease in cattle. Jour. A. V. M. A., lxx (1026), n. s. 23 (2), pp. 229-233.

SOCIETY OF PHI ZETA

Alpha Chapter of the Society of Phi Zeta, honorary veterinary society of the New York State Veterinary College at Cornell University, announces the election of the following to membership: Drs. R. S. MacKellar, New York; F. E. McClelland, Buffalo; R. W. Gannett, Brooklyn; J. M. Hendrickson, Farmingdale, Long Island; Capt. E. M. Curley, Veterinary Corps Unit, Military Department, Cornell University; Messrs. J. C. Thomson, S. E. Ferguson, W. A. Kelley and C. J. Parshall.

Messrs. Thomson and Ferguson are senior students in the Veterinary College; Kelley and Parshall are juniors.

The initiation exercises and dinner of the Society were held in Prudence Risley Hall, on the evening of January 15, 1927.

CLINICAL AND CASE REPORTS

(Practitioners and others are invited to contribute to this department reports of unusual and interesting cases which may be helpful to others in the profession.)

UTERINE PROLAPSE, A COMPLICATION OF MILK FEVER

By JOHN F. RANKIN, *Astoria, Ore.*

In the past three months I have had four cases of milk fever in which the uterus was prolapsed. Each case showed symptoms of milk fever. All the cows were in a comatose condition and uterine contraction had entirely ceased.

I first replaced the uterus, because when a cow is in a comatose state you do not get straining against your efforts to replace the prolapsed organ, whereas, if you treat the cow for milk fever first, she would probably regain enough strength to make replacement difficult, because of constant straining.

The cases were all treated out in the pasture and there being no means to elevate the hind quarters of the cow, a tripod of three poles, each about twelve feet long, was constructed over her, and a block and tackle attached. A short rope was looped around each leg above the hock and the free end was then looped into the hooks of a long singletree, to which the block and tackle was attached. Before hoisting the patient a freshly-laundered sheet was placed under the uterus and the placental membranes were removed. The uterus was cleansed well with a damp sponge, then the entire uterus was bathed in warm mineral oil, to which one-half of one per cent oil of eucalyptus was added. The sheet was held about the organ for support and to prevent contamination while the cow was being hoisted to an elevation of two feet. An assistant stood on each side of me, holding the ends of the sheet in such a manner as to make replacement easier by gravitation. Using the right arm, hand closed, it was gently thrust into the apex of the prolapsed organ. The arm was carefully pushed into the abdominal cavity, being inserted almost to my shoulder, carrying the apex of the uterus gradually to the normal position. The remainder of the organ was easily replaced.

This method is very much easier, and less liable to injure the mucous membrane or to rupture the uterus than the old method

of beginning the replacement from the vulva backward. A pint to a quart of the warm oil was injected into the uterine cavity and the organ repositioned by straightening and pressing out the folds with the hand. Three or four interrupted sutures were placed in the lips of the vulva with a seton-needle and a two-inch bandage helped to retain the organ. Then the cow was placed on her right side, the head slightly down hill, as this seems to aid in attaining the normal position.

In every case of prolapsed uterus I found the cow lying on the left side, but whether this had anything to do with causing the prolapse, I can not say. All cases I met with were identical, except that in one case the placental membranes were not attached, and in two cases there was tympanites, which was relieved by a small trocar before attempting replacement.

The milk fever was treated by giving one-half grain of atropin sulphate subcutaneously and udder inflation. Next, the cow was catheterized, that is, in cases where it was necessary, and a sodium chlorid enema was given. In persistent cases, however, I fill the stomach with three or four gallons of saline solution. The cow was next placed on her sternum and propped up in a comfortable position so that there would be pressure on the udder for I believe a cow recovers more quickly in this position. Three cubic centimeters of adrenalin chlorid 1-1000 was given subcutaneously, just before leaving the case. The cows were on their feet within three to five hours after treatment. The owner of one of the cows found her the next morning in two feet of slough water. She was hauled out with a team, but was on her feet again in an hour. All of the cows made good and uneventful recoveries.

REMOVAL OF FOREIGN BODY FROM EYE OF DOG

By C. L. SANDERS, *Dayton, Ohio*

A Boston bull terrier, about two and one-half years old, was brought in from McCook Flying Field, with a brier in the eye. The dog was placed on the examination-table and a reading-glass used to see how deeply in the eye the object was imbedded. The examination disclosed that the foreign object had pierced the cornea and lay lengthwise, possibly in the aqueous humor.

Two and one-half grains of morphin sulphate was given and an hour allowed to elapse. We then used a medicine-dropper and instilled about thirty drops of a two per cent procain solu-

tion into the eye. After about five minutes we tested for reflexes and apparently we could have done anything to the eye that was necessary. After sterilizing a dental pick I pushed it down and under the foreign object, using the reading-glass, and lifted it out on the sclerotic portion of the eye.

Later I put the object on the point of a needle and placed it under the microscope. I ascertained it to be a rose thorn. We flushed the eye with a twenty per cent solution of argyn (Abbott) and after a while placed some silver nucleinate ointment in the eye. This case recovered uneventfully and to date we are not aware of anything further having developed.

TWINS FOLLOW QUADRUPLETS

By HARRY ROSS, *Brandon, Manitoba*

The world's most famous cow, Aaggie Segis Calamity 18349, who, eighteen months ago gave birth to quadruplet calves, all being alive at the present time, hale, hearty and vigorous, gave birth to twin calves, a male and a female, on the morning of December 26, 1926.

DRIED ORANGE JUICE RETAINS ANTISCORBUTIC VITAMIN

In the future compact little packages of dried orange-juice will probably form an essential part of ships' supplies. It is well known that citrus fruits are rich in vitamin C, which has the property of preventing scurvy, a disease from which sailors on long voyages used to suffer greatly in years past. Recent experiments have shown, according to a report about to be published in the *Journal of Biological Chemistry*, that orange-juice can be dried and still retain its health-giving vitamins after long periods of time. A mixture of orange-juice and sugar, when removed from a partial vacuum where it has been left for five years, still retained its power to prevent scurvy in guinea pigs living on a diet otherwise free from vitamin C.—*Science.*

ETIOLOGY

The ancients thought the lunatic
Was one by Luna's rays made sick,
But coming down to present time
We *know* 'tis caused by plain "moonshine."

—N. S. M.

REVIEW

SCHECHITAH UND BEDIKAH (Rituelle Schlachtung und Innere Untersuchung). Dr. Med. Vet. Bruno Lauff, Direktor des Stadtischen Schlacht und Viehhofes in Mulcheim an der Ruhr. iv + 71 pages. Richard Schoetz, Berlin, 1925.

This pamphlet treats exhaustively of the Jewish ritual slaughtering, and the inspection of animals for food purposes from the standpoint of modern hygiene and meat inspection science is critically discussed in all its aspects. The question as to which method of slaughter is most humane is discussed in detail.

The first meat-inspection regulations were prescribed by Moses and are recorded in the Talmud. Others have been transmitted orally from generation to generation and, while not carried out with the original ritualistic exactitude, it is interesting to note the methods followed with the limited knowledge of animal diseases that was available in the early centuries.

Minute instructions are given how to prepare the knives, the method of cutting the throat at the designated point and other preliminaries. The Mosaic law does not prescribe an examination of any organs other than those in the thoracic cavity. A careful inspection of the throat incision precedes this.

The use of blood as a food article for the human is strictly prohibited. There is a radical difference between this ancient sanitary law and our modern meat inspection system. In the United States, at least, the regular government or municipal inspection is applied in addition to the Jewish ritualistic inspection before the carcass is passed as Kosher.

J. H.

ABSTRACTS

THE INHERITANCE OF RESISTANCE TO BACILLARY WHITE DIARRHOEA. E. Roberts and L. E. Card. Poultry Science, vi (1926), 1.

The authors consider, as one of the possible means of reducing losses from bacillary white diarrhea, the establishment of immune or resistant stocks. This production of resistant stocks is possible only if resistance to disease is hereditary. The authors state: "The term 'resistance' is used rather than immunity for the reason that it is entirely conceivable that an animal may possess

hereditary resistance and yet not be completely immune to a given disease under all conditions."

The authors had three objects in view in their investigation:

(1) To study the variability in resistance to bacillary white diarrhea existing among chickens of the same and different breeds.

(2) If resistance should be found, to study its inheritance.

(3) If it should be found hereditary, to establish resistant strains.

The work of the first year consisted of inoculating chicks with cultures of *S. pullorum* for the purpose of studying the variability of resistance. Of a total of 335 day-old chicks injected, 53 were found resistant and 92.5 per cent of these so-called resistant chicks came from one flock. This flock had the history of having trouble, some years before, with disease of the nature of bacillary while diarrhea and the flock had been more or less inbred.

The second year also showed the greatest percentage of resistant chicks in a flock of inbred stock (brother and sister for three generations), of which 50.4 per cent of the chicks were resistant.

The third year the work consisted of inoculating day-old chicks from known resistant stock and from random stock. Fifty-five per cent of the chicks from resistant stock were found resistant and 10.1 per cent of the random stock were found resistant.

The conclusions of the authors are:

(1) Great variation exists among chickens with respect to their resistance to infection with *S. pullorum*.

(2) The occurrence of resistant chicks is such as to indicate a natural resistance that is hereditary.

(3) Chicks from certain hens are much more resistant to infection than are the chicks from other hens, when the measure of resistance is the percentage of chicks that survive an inoculation, at approximately twenty-four hours of age, with a pure culture of *S. pullorum*.

(4) The occurrence of resistance is sufficiently consistent among chicks from certain hens and flocks to suggest that it may be possible to establish a strain of fowls that will be highly resistant to infection with *S. pullorum*.

E. L. S.

IODINE ON THE POULTRY FARM. W. L. Chandler. Poultry Science, vi (1926), 1.

The author writes that iodin, in addition to its use as a food requirement and an antiseptic, has two other important uses on

the poultry farm; that of dosing birds for worms and the treatment of poultry houses and runways for the destruction of worm eggs and larvae and coccidian cysts. The author states that the lethal action on worms, worm eggs and worm larvae appears to be due to a chemical reaction and that in order to produce this reaction the iodin must be in the free (uncombined or elemental) state.

This so-called free iodin has been produced as a commercial product. For the dosing of the birds it is called "Iodine Vermicide" and for the treatment of the ground, "Iodine Suspensoid."

It is stated that the "effective dose for ascaridia, gizzard-worms and capillaria worms, and most tapeworms of poultry ranges from one-half ounce, in the case of young birds, weighing from one to three pounds, to one ounce for adult birds." It is administered directly into the gizzard by means of a slightly flexible catheter.

The procedure for destroying the worm eggs, larvae and coccidian cysts is: First, mechanically remove and burn or otherwise satisfactorily dispose of all organic matter possible from the floors, dropping-boards, roosts and the like; second, flood the surfaces, portions at a time, with the dilute suspensoid, using two gallons per 100 square feet, scrubbing the surface at the same time with an old broom and then flood the surfaces with dilute suspensoid, using one gallon per 100 square feet.

The author also reports on experiments in dosing birds where it seems that the treatment aided the development of the birds, because treated birds gained weight faster than untreated ones.

E. L. S.

THE EFFECT OF CHEMICALS IN THE CONTROL OF POULTRY DISEASES. I—PRELIMINARY EXPERIMENTS WITH BACILLARY WHITE DIARRHOEA. Henry G. May and Herman E. Segelin. Poultry Science, vi (1926), 1.

These experiments were undertaken because of the very few experimental data available on the effect of chemicals in the control of poultry diseases. The chemicals used just killed pullorum cultures in 15 minutes in the following dilutions, but failed to kill in higher dilutions:

Sulphocarbolate compound (Abbott), 1:10; mecuric chloride-sulphocarbolate mixture (1 part, mecuric chloride; 1 part, sodium sulphocarbolate; 1 part, calcium sulphocarbolate; and 2 parts,

zinc sulphocarbolate), 1:320,000; potassium permanganate, 1:20,000; hypochlorite (solution containing 1 per cent available chlorin), 1:500; copper sulphate, 1:40; ferrous sulphate, 1:200; ferrous sulphate (1:1000 sulphuric acid), 1:300; sulphuric acid, 1:1000.

The experiments were carried out by giving the chicks the chemical solutions in place of drinking water for 5 to 15 hours prior to infection and this water was changed twice daily, with no other water available.

The chicks were infected by giving a 24-hour broth culture of *S. pullorum* mixed with the mash for four or five consecutive feedings.

Potassium permanganate (1:1000), hydrochloric acid (1:250), mecuric chlorid-sulphocarbolate mixture (1:10,000), resorcin (1:250 and 1:400) and sulphuric acid (1:500) failed to show any effectiveness in reducing mortality of chicks artificially infected with *S. pullorum*.

Hypochlorite in a dilution containing 1.02 per cent free chlorin, in four trials involving 80 chicks, reduced the mortality over 50 per cent and warrants further investigation.

With the exception of hydrochloric acid and the hypochlorite solution, which produced gains in the infected chicks equal to those of the uninfected controls, none of the chemicals showed any decided benefit to the surviving chicks; in some instances they were harmful rather than beneficial.

E. L. S.

PUBLICATIONS RECEIVED

Colorado Agricultural College Bulletin, Catalog 1926-1927. Fort Collins, Colo., March, 1926. pp. 184.

Suggested Method to be Followed in Developing a Standard Course for Medical Technicians. Walter E. King. Detroit, Mich. Reprint from *Journal of Laboratory and Clinical Medicine*, xi (1926), 7. pp. 8.

The Veterinary Profession. (Ohio State Univ. Bul., xxx (1926), 23. Columbus, Ohio. pp. 25. Illustrated.)

The Epizootic of Foot-and-Mouth Disease in California. Charles Keane. (Spec. Bul. 65, Calif. Dept. Agr., Sacramento, Calif., 1926. pp. 54. Illustrated.)

Ovarian Follicular Hormone. (Research Bul. 3, Parke, Davis & Co., Detroit, Mich. pp. 16.)

A Study of Hernia in Swine. B. L. Warwick. (Research Bul. 69, Agr. Exp. Sta., Univ. Wis., Madison, Wis., Sept. 1926. pp. 27. Illustrated.)

Report of the Veterinary Director General (Dept. of Agr., Canada) for the year ending March 31, 1926. Ottawa, Ont., 1926. George Hilton. pp. 41.

Growing Plants as Possible Carriers of Anthrax. Harry Morris and Harland K. Riley. (Bul. 196, La. State Univ. and Agr. & Mech. Coll., Baton Rouge, La., October, 1926. pp. 16.)

ARMY VETERINARY SERVICE

CHANGES RELATIVE TO VETERINARY OFFICERS

Regular Army

Second Lieutenant Ernest E. Hodgson is relieved from duty at the Army Veterinary School, effective at the close of the current course of instruction, January 31, 1927, and is directed to report to the commanding officer, Fort Benning, Ga., for temporary duty for a period of 4½ months and then proceed to Fort Bliss, Texas, for duty.

Lt. Colonel Walter Fraser is directed to sail January 13, 1927, from San Francisco for Hawaii for duty, instead of February 19, 1927, as previously ordered.

Each of the following veterinary officers is relieved from duty as student at the Army Veterinary School, effective at the close of the present session January 31, 1927, and is then directed to report for temporary duty as student at the Medical Field Service School, Carlisle Barracks, Pa. Upon completion of the course thereat, each officer is directed to report for duty at the station indicated:

Capt. Louis G. Weisman, Fort Benjamin Harrison, Ind.
Capt. John W. Miner, Front Royal Q. M. I. D., Front Royal, Va.
Capt. Henry E. Hess, Madison Barracks, N. Y.
Capt. Jacob L. Hartman, Fort Benning, Ga.
Capt. Ralph H. Lewis, Fort Sam Houston, Texas.
Second Lieut. Stanley M. Nevin, Fort Sam Houston, Texas.
Capt. Harry J. Juzek, Army Veterinary School, as instructor.
Capt. Clifford E. Pickering, San Francisco, Calif.

First Lieut. Jack G. Fuller, now on duty in the Philippine Islands, promoted to grade of captain, effective November 26, 1926.

Reserve Corps

New Acceptances

Dick, John Seigbert, Jr., Captain, 1332 Marshall St., N. E., Minneapolis, Minn.

Julian, Cyrus W., 2nd Lieut., Box 881, Visalia, Calif.

ESSAY CONTESTS

Colonel W. George Turner, Director of the Army Veterinary Corps, has announced that the following subject has been selected by the Surgeon General's Office for the 1927 essay contest for cash prizes offered by the American Veterinary Medical Association:

"The Importance of Veterinary Meat and Dairy Inspection in Maintaining the Health of Troops."

The contest is open to regularly enrolled senior students in all of the thirteen veterinary colleges, in the United States and Canada, recognized by the A. V. M. A. The first prize is $50.00 and the second, $25.00. Further information relative to the contest, closing dates, etc., may be secured by writing Colonel W. George Turner, Office of the Surgeon General, Washington, D. C.

COMMUNICATION

ELECTION OF A VETERINARIAN TO THE HOUSE OF DEPUTIES OF THE ARGENTINE NATIONAL CONGRESS

To the Editor:

Veterinarians in this country who are concerned over securing recognition for the veterinary profession will, no doubt, be interested to learn of the honor accorded a fellow-veterinarian in the Argentine, who has recently been elected a member of the House of Deputies of the Argentine National Congress, corresponding to our National House of Representatives.

El Campo, one of the foremost monthly agricultural papers of Buenos Aires, in its issue of September 15, 1926, featured as its leading article the election to membership in the National House of Deputies of Dr. Pedro Podestra, a veterinarian graduated from the University of Buenos Aires.

After calling attention to the fact that there are too few legislators who sufficiently investigate and comprehend the true needs of the basic industries of the country, so as to give to agriculture and the live stock industry the legislation merited, *El Campo* states: "It will be understood, then, why we consider the ingress to the National Chamber of Deputies of Dr. Pedro Podesta, distinguished veterinarian of the University of Buenos Aires, as an augury for the rural interests. His first acts in Congress demonstrate clearly the spirit which animates him and also his predilection for the problems of a general character."

In addition to having introduced a bill tending to popularize the teaching in the public schools of agricultural subjects pertinent to the section of the country involved, Dr. Podesta is the author of a bill designed to assist in combating the spread of tuberculosis of animals by prohibiting the sale for breeding purposes of bovine and swine male animals ("reproductores") which are infected with tuberculosis.

By the provisions of this bill, the finding of the animal to be tuberculous within fifteen days following the date of delivery to the buyer would, of itself, make the sale null and void. Suitable provision is made for the diagnosis of tuberculosis to be established by veterinary experts and the necessary legal course of procedure is outlined.

In discussing the bill Dr. Podesta calls attention to the fact that tuberculosis is, at the present ime, encountered principally in the pure-bred breeding establishments (cabanas) and in the dairy herds. The further dissemination of the disease to range animals, or other breeding establishments and dairy herds, would be materially checked by preventing the sale of infected male breeding animals for other than purposes of slaughter.

Dr. Podesta is further quoted as stating: "This plan is sufficiently simple, but on the other hand, the adoption of a plan for general tuberculosis prophylaxis is something which must be considered with caution, since although ultimate extermination is to be sought, this must be accomplished with the least possible loss to the owner. Only by proceeding in this way, will it be possible to obtain the indispensable collaboration of the owner."

Considering that, in the Argentine, the common practice in raising animals on the range, is to buy pure-bred male animals from breeding establishments for crossing upon common stock, the beneficial effects in combating the further spread of tuberculosis infection, which could be obtained from the adoption of the plan proposed by Dr. Podesta, are apparent. For the protection of the live stock industry it is to be hoped, as an initial step in the fight against tuberculosis, that such a measure may eventually be enacted into law and subsequently enforced.

H. K. WRIGHT.

Philadelphia, Pa., Dec. 28, 1926.

BUREAU TRANSFERS

Dr. John R. Urich, from Columbia, S. C., to Harrisburg, Pa., on tuberculosis eradication.

Dr. Charles A. Raque (Amer. '93), from Des Moines, Iowa, to Albuquerque, N. Mex., on tuberculosis eradication.

Dr. James A. Sluss (Ind. '21), from Chicago, Ill., to Knoxville, Tenn., on meat inspection.

Dr. Frank B. Perdue (Chi. '13), from Chicago, Ill., to Ottumwa, Iowa, on meat inspection.

Dr. Orville A. Stingley (K. C. V. C. '02), from Kansas City, Mo., to Albert Lea, Minn., in charge of meat inpsection.

Dr. J. L. Owens (Colo. '26), from Chicago, Ill., to Tacoma, Wash., on meat inspection.

Dr. Levi Chas. Henderson (K. C. V. C. '04), from Indianapolis, Ind., to Olympia, Wash., on hog cholera control.

Dr. Elmer N. Davis (K. C. V. C. '16), from Chicago, Ill., to Omaha, Nebr., on meat inspection.

Dr. Ernest F. Ahnert (U. P. '13), from Reno, Nev., to Omaha, Nebr., on meat inspection.

Dr. Robert N. Ashley (K. C. V. C. '08), from Huron, S. D., to Reno, Nev., on meat inspection.

Dr. Orville R. Whitney (Iowa '16), from Chicago, Ill., to Huron, S. D., on meat inspection.

MISCELLANEOUS

DR. YOUNGBERG APPOINTED DIRECTOR

Word has been received that Dr. Stanton Youngberg has been appointed director of the Bureau of Agriculture, Department of Agriculture and Natural Resources of the Philippine Islands. Dr. Youngberg was graduated from the Ohio State University in 1907 and has now been in the Philippines for almost twenty years. He probably has a better knowledge of Philippine conditions than any other American now on the Islands. He was

DR. STANTON YOUNGBERG

appointed veterinarian in the Bureau of Agriculture, August 27, 1907; promoted to the rank of supervising veterinarian, January 1, 1909; and to the rank of chief veterinarian, June 1, 1914. In August, 1923, he was the Philippine delegate to the Pan-Pacific Scientific Congress, held in Australia. In December, 1924, he was appointed acting director of the Bureau of Agriculture and, November 10, 1925, made ad interim director. His appointment as director took effect November 9, 1926. This important post automatically makes Dr. Youngberg chairman of the Fiber

Standardization Board, as well as a member of the Tobacco Board.

A few days following his appointment, the Bureau of Agriculture personnel tendered a complimentary luncheon in honor of Dr. Youngberg, on the confirmation of his appointment as director. Capt. R. A. Kelser, of the Veterinary Corps of the United States Army, who has been in the Philippines for about two years, was among those who attended the luncheon. Dr. Youngberg and Capt. Kelser have been cooperating on some research problems in connection with rinderpest. These investigations have reached the stage where they may be said to be "promising."

DR. HART IN AUTOMOBILE ACCIDENT

Dr. George H. Hart, chief of the Division of Animal Husbandry of the University of California and member of the Executive Board of the A. V. M. A. for District No. 6, was seriously injured, when his automobile skidded on the wet pavement

DR. GEORGE H. HART

near Fairfield, Calif., December 17, 1926. Dr. Hart was driving alone and his car overturned, pinning him beneath it. He was rescued by a passing motorist who took him to a nearby hospital. Later he was removed to the Woodland Hospital, where it was

found that his injuries consisted of a broken collar-bone, several fractured ribs, a fracture of the pelvis and extensive lacerations of the face and head. It was reported that Dr. Hart might lose one ear as a result of the extensive injuries to that organ. Later reports indicate that Dr. Hart is making satisfactory progress toward recovery. On account of the extent of his injuries, however, it is quite likely that he will be confined to his bed for another month.

A VEST POCKET ESSAY ON "ROLLS"

By I. K. ATHERTON, *College Park, Md.*

A journal devoted to the betterment of live stock has broached the momentous question "Does a mule get as much enjoyment out of his evening roll as a city man derives from his breakfast roll?" Owing to the reticence of the mule to discuss personal habits, this will probably remain one of the great unsolved questions of the age. However, if the mule gets no more of a thrill from his evening frolic than the average city man does from his morning nose-bag, it is certainly a case of nature-faking if he should give the slightest evidence of any pleasure at all. Thousands of wives will testify that if the mule expresses no more satisfaction over his daily dozen at the close of the day than husbands do over their morning's bakery product, a large-size vocabulary will not be needed to answer the purpose. It was recently alleged that science had discovered that fresh bread contains a much larger percentage of alcohol than Mr. Volstead deems good for the stomach, and this knowledge may add zest to the leavened dyspepsia-producer not heretofore experienced. Even with this high percentage of the forbidden stimulant in the morning meal, it does not provide the same "kick" enjoyed by the mule in closing up the affairs of the day. When it comes right down to the roll that gives universal satisfaction, the roll-tops lead the league.

The roll which is pre-eminent in the hog-lot is that composed of fat. One never hears of the matrons or flappers in the swine world going on a diet, or the masculine members golfing to prevent getting too fleshy. A hog was recently butchered in Maryland that tipped the scales at 1,350 pounds. It might be that this animal was stunted in some manner early in life, or it probably would have made quite a good-size hog. The carcass produced eleven fifty-pound cans of lard. While on this subject it must

be understood that the cash customer will get only about nine pounds of lard this winter for every ten he pays for. This is due to the fact that about 10 per cent of the hogs in the United States this year have gone to the happy rooting-grounds via the hog-cholera route. Maryland lost about 3,600 hogs during the months of October and November from this disease. But stop! Was the hog cholera "bug" really to blame? Over 95 per cent of these losses were directly or indirectly due to infected pork which was fed the hogs in garbage, table scraps, kitchen swill, etc. Therefore, over 3,300 of these hogs could have been saved by the simple process of keeping this infected material out of the hogs' feed. Maybe it was all worth while, though, if the lesson is heeded.

DR. TURNER ON LEGISLATIVE COMMITTEE

Dr. J. A. Kiernan, chief of the Tuberculosis Eradication Division of the Bureau of Animal Industry, who has been a member and chairman of the A. V. M. A. Committee on Legislation for the past year, has found it necessary to resign this committee assignment on account of the pressure of his official duties. President Sigler made a careful study of the situation and offered the position made vacant by Dr. Kiernan to Dr. John P. Turner, of Washington, D. C. It was deemed highly desirable to have the chairman of this important committee located in Washington. Furthermore, Dr Turner has had previous experience on the Committee on Legislation, having served as a member from 1916 to 1920 and as chairman for the year 1920-1921. Dr. Turner has indicated his acceptance of this important appointment and, by the time this announcement is read by our members, the A. V. M. A. Committee on Legislation will be busily at work on the several pieces of national legislation in which veterinarians are interested.

Not the violent conflict between parts of the truth, but the quiet suppression of half of it, is the formidable evil; there is always hope when people are forced to listen to both sides; it is when they attend only to one that errors harden into prejudices, and truth itself ceases to have the effect of truth, by being exaggerated into falsehood. * * * Truth has no chance but in proportion as every side of it, every opinion which embodies any fraction of the truth, not only finds advocates but is so advocated as to be listened to.—*John Stuart Mill.*

ASSOCIATION MEETINGS

CENTRAL CANADA VETERINARY ASSOCIATION

The annual meeting of the Central Canada Veterinary Association was held in Ottawa, December 15, 1926. The meeting was well attended, and the lively discussions, which followed the papers, demonstrated the interest of the members. Following the meeting many expressed the opinion that it was the most successful meeting, from an educational standpoint, that the Association has had in many years.

The first paper of the afternoon session was given by Dr. E. F. Johnston, of Carp, whose subject was "Digestive Disorders of Cattle." The principal disorders of cattle were dealt with and the treatments found most effective by the lecturer described. A lively discussion followed. "Rabies from a Clinical Standpoint" was given by Dr. J. A. Campbell, who has had a wide experience with this disease in the ordinary domestic animals, particularly in dogs. He described in detail the symptoms noted in each species. The last paper of the afternoon session, entitled "Unusual Conditions Met with in Veterinary Practice," was given by Dr. N. M. Bellamy. A number of unusual conditions, such as mercury poisoning and tobacco poisoning, were ably described. The session then adjourned.

The members of the Association were the dinner guests of Dr. A. E. Cameron, Chief Inspector of the Department of Agriculture.

Dr. C. H. Weaver opened the evening session with a paper on "Poultry Diseases." He dealt ably with the important maladies affecting Canadian poultry. Dr. J. B. Hollingsworth followed with an interesting paper, "Sterility in Cattle." A very lively discussion ensued. "Botulism," the last paper of the evening, was given by Dr. Chas. A. Mitchell.

CHAS. A. MITCHELL, *Secretary.*

KEYSTONE VETERINARY MEDICAL ASSOCIATION

The regular monthly meeting of the Keystone Veterinary Medical Association was held December 15, 1926, at the Veterinary School, University of Pennsylvania. This meeting was held about a week earlier than usual, in order to avoid the Christmas holidays. The regular monthly meeting date is the fourth Wednesday of the month. The meeting was very well attended.

Drs. L. A. Klein, M. F. Barnes and E. L. Stubbs reported on the meetings held in Chicago, during the week of the International Live Stock Show. Dr. Romano, of New York, addressed the meeting and the members were all very much interested in his talk.

C. S. ROCKWELL, *Secretary-Treasurer.*

DELAWARE VETERINARY MEDICAL ASSOCIATION

The annual meeting of the Delaware Veterinary Medical Association was held in Grange Hall, Dover, December 17, 1926. Dr. H. P. Eves called the meeting to order at 2:15 p.m.

President Eves made a short address in which he lamented the fact that Delaware does not have a state veterinarian to direct the policies of the state along disease-control lines. He stated that, in his opinion, the Association should work to have a veterinarian appointed upon the State Board of Agriculture.

The committee conferring with the State Board of Agriculture on tuberculin testing was congratulated on their efforts. In the future the accredited herds will be retested by Delaware accredited veterinarians. The committee was composed of Drs. H. B. McDowell, chairman, F. P. Ruhl and Louis Levinson.

Dr. W. C. Reeder, of the Supplee-Wills-Jones Company, gave a most interesting and instructive talk on the physical examination of dairy cows and inspection of dairy equipment. Dr. Reeder stated that this field of work is opening up new opportunities for veterinarians and that veterinary schools should give more attention to the subjects necessary in this work. This lecture was followed by an interesting discussion of dairy inspection and milk-borne diseases.

The election followed and the 1926 officers were all unanimously re-elected for another year, with the exception of Dr. C. C. Palmer, who declined re-election as secretary. The success of the Association has, in a great measure, been due to the efficient work of Dr. Palmer and everyone regretted Dr. Palmer's declination of the office. Dr. Louis Levinson, of Middletown, was elected to the office of secretary.

The past year was one of the most successful for the Association. Plans are being laid to bring the veterinarians of Delaware a little more to the front in 1927.

LOUIS LEVINSON, *Secretary.*

NORTHEASTERN PENNSYLVANIA VETERINARY MEDICAL CLUB

A meeting of the Northeastern Pennsylvania Veterinary Medical club was held on December 18, 1926, at Wilkes-Barre, in the Terminal Hotel. Dr. W. J. Lentz, of the University of Pennsylvania, lectured on the "Anatomy of the Genital Tract of Cattle." Dr. Lentz' talk was very pleasing to all present.

Mr. Edward F. Harrison, president of the Chemo-Mechanical Water Improvement Co., Philadelphia, was also present and gave a talk on "Sanitary Sewage." Mr. Harrison discovered and promoted a simple, practical and reliable process for the purification and disposal of municipal sewage by a biological-chemo-mechanical method. Mr. Harrison published the first treatise describing the value of intense mechanical agitation with air under pressure, using the new and old precipitates for clarification without the use of filters, and returning the product of the process to the fresh incoming sewage preparatory to its treatment to shorten the time required to obtain the best results for sewage reclamation and disposal. The outstanding features of this process are: (1) Using certain ingredients in the sewage for effective treatment of same; (2) forcing a reaction in a minimum of time; (3) effective clarification without filtration; (4) mechanical design to best effect the employment of chemical-biological principles to sewage treatment; (5) production of a product that has a high commercial market value as a fertilizer; (6) transforming a heretofore complicated, intricate and highly technical process into one of such simplicity that technical training for the operation is unnecessary. Mr. Harrison for years has vigorously opposed the decay method of sewage disposal, as being insanitary and wasteful. He contends that the meaning of sanitation is to prevent decay and to make sterile and he conducted research work along these lines. This is one of the many branches that is required of the veterinary service, which brings out the fact that the field for the veterinarian is becoming much larger than it has been in the past.

Dr. H. R. Church, Deputy State Veterinarian, also gave a talk, which was very interesting and instructive, because of the information it contained pertaining to live stock.

These lectures are received from time to time from the Veterinary Extension School of the University of Pennsylvania, and are highly educating. They are nothing more nor less than a

post-graduate course for the veterinarians of the state of Pennsylvania.

THOS. D. JAMES, *Secretary.*

NORTH CENTRAL IOWA VETERINARY MEDICAL ASSOCIATION

The North Central Iowa Veterinary Medical Association met at Fort Dodge, December 20, 1926. There were approximately seventy members in attendance. Dr. L. M. Graham, of Rolfe, Iowa, presided. Following the transaction of routine business the following program was presented:

"Small Animal Practice," Dr. C. H. Covault, Iowa State College.

Discussion opened by Dr. W. F. Miller, Storm Lake.

"Cattle Practice," Dr. E. R. Truax, Sac City.

"Poultry Practice," Dr. W. P. Bossenberger, Williams.

Paper, Dr. A. Kaderabek, Fort Dodge.

In addition to the papers, we were fortunate in having with us Hon. M. G. Thornburg, Secretary of Agriculture, who gave a most interesting talk on the work done by his Department, in which the practicing veterinarians of the State assisted. Dr. Peter Malcolm, state veterinarian, also addressed the meeting.

The meeting concluded with a banquet served at 6:30 at the Wahkonsa Hotel.

H. J. SHORE, *Secretary.*

INTERMOUNTAIN LIVESTOCK SANITARY ASSOCIATION

The Intermountain Livestock Sanitary Association was enthusiastically organized January 6, 1927, at a banquet held in the Chamber of Commerce, Odgen, Utah, by prominent veterinarians from Colorado, Wyoming, Nevada and Idaho, attending the Intermountain Livestock Show. Dr. H. J. Frederick, professor of veterinary medicine at the Utah Agriculture College, was elected president.

Other officers of the Association are: Dr. A. G. Fisk, Greeley, Colo., first vice-president; Dr. L. C. Butterfield, Reno, Nev., second vice-president; Dr. John T. Dallas, Cheyenne, Wyo., third vice-president and Dr. W. D. Wright, Ogden, Utah, secretary-treasurer.

Dr. F. E. Murray, of Salt Lake City, presided and the following program was given during the evening session:

"Hog Cholera," by Dr. W. A. Sullivan, Boise, Idaho.
Discussion led by Dr. C. C. Perry, Salt Lake City, Utah.
"Biologics," by Dr. R. W. Hoggan, Salt Lake City, Utah.
"Poultry Diseases," by Dr. Arthur Vance, Provo, Utah.
Discussion led by Dr. A. J. Webb, Ogden, Utah.
"Contagious Abortion," by Dr. E. P. Coburn, Richmond, Utah.
Discussion led by Dr. W. H. Hendricks, Salt Lake City, Utah.
"Feed Lot Losses," by Dr. W. T. Huffman, Boise, Idaho.
Discussion led by Dr. M. L. Killpack, Murray, Utah.
"Organization of an Intermountain Livestock Sanitary Association," Dr. F. E. Murray, Salt Lake City, Utah.

W. D. WRIGHT, *Secretary.*

SCHOOL OF INSTRUCTION FOR THE CHICAGO FORCE OF THE B. A. I.

Dr. Herman Busman, B. A. I. inspector-in-charge of meat inspection at Chicago, has reestablished a school of instruction for the veterinarians on his force. The object of these meetings is to better acquaint the inspectors, especially the new employes, with the rules and regulations of the B. A. I., the diagnosis of pathological conditions encountered on the killing-floors, and the proper disposition of animals found to be diseased. Instruction concerning the various departments of a modern packing-house, such as sausage-making, pickling, curing,smoking, oleomargarine-making and lard-refining, are also given, so that when an inspector is chosen for promotion to the position of supervisor or inspector-in-charge he will have a good working knowledge of the various duties he will assume.

These meetings are held once a month, in a large hall conveniently located. An interesting program is prearranged by a program committee, consisting of Drs. A. A. Swaim, W. W. Worcester and J. S. Bengston. The time of these meetings is the morning of the second Monday of each month, at 9:30. This time was selected because so few of the packers do any killing before noon on Monday, and this enables practically all the veterinarians to attend the meetings. All inspectors not on official duty are expected to be present.

At the meeting held January 10, Dr. L. M. Marshall presented a very interesting paper entitled, "Animal Parasites Commonly Met with in Meat Inspection." Drs. M. Borsos and H. B. Raffensperger led in the discussion of this paper. Dr. L. E. Day, in charge of the pathological laboratory in Chicago, followed with detailed descriptions of the gross and microscopic

appearances of various pathological specimens recently encountered in meat inspection. The specimens which were being discussed were passed among the inspectors at the time of the discussion, so that each man might become thoroughly familiar with the specimen under discussion.

One of the most interesting specimens presented by Dr. Day was the lungs, heart and larger blood-vessels of a three-year-old cow. The lungs contained numerous deposits of true bone in the walls of the air-vesicles. The lining membrane of the auricles of the heart and the tunica intima of the larger blood-vessels contained both bone and calcareous deposits. This is only the third or fourth such case that has been received at the Chicago laboratory in the past fifteen years. Dr. Day explained that the bone and calcareous deposits were due to the loss of equilibrium of the calcium metabolism of the body, with resulting deposition of calcium. Under such conditions this is most likely to occur in the acid-excreting organs of the body, such as the lungs, kidneys and stomach.

The next subject on the program has proved to be of great interest as well as being highly instructive. It is known as the question-box. The inspectors are encouraged to write out questions that have come up in their work, concerning rules and regulations, pathological conditions, and all forms of inspection procedure, including antemortem inspection and field work. These questions are sent to the program committee in advance of the meeting and are assigned to individuals especially fitted to answer them. At the time of the meeting the questions are read and the men selected to answer them give short, accurate, prepared answers. In this way the inspectors obtain much valuable information and each man has the opportunity to obtain the particular information he desires.

J. S. Bengston.

SOUTHEASTERN MICHIGAN VETERINARY MEDICAL ASSOCIATION

The annual meeting of the Southeastern Michigan Veterinary Medical Association was held at the Detroit Board of Health headquarters, January 12, 1927. The meeting was preceded by the usual dinner and roll-call showed the attendance to be thirty-eight.

The committee appointed at the December meeting to draw up a resolution relative to the proposal of the Michigan Humane Society to take over the city dog pound made a report. The

resolution was read and the Association was informed that the Common Council had taken final action on the matter that day. The application of the Humane Society to take over the dog pound was declined and the Council decided to keep the dog pound under the jurisdiction of the Police Department.

Mr. L. J. Van Schoick, of the Detroit Convention and Tourist Bureau, addressed the Association for the purpose of letting the members know what his Bureau would do in the event of Detroit being selected for a meeting of the American Veterinary Medical Association. After listening to Mr. Van Schoick and discussing several important angles of the question, it was moved by Dr. H. T. Carpenter and seconded by Dr. E. E. Patterson that we invite the A. V. M. A. to meet in Detroit in 1928.

Dr. Ward Giltner, of Michigan State College, was present and explained in detail the program for the fourth annual postgraduate short course for veterinarians to be given by the Veterinary Division at East Lansing, January 24-28. Dr. Giltner expressed the wish that as many of the local veterinarians as possible attend.

Dr. B. H. Swim, of the U. S. Bureau of Animal Industry, read a splendid paper, entitled, "The Lymphatic System." Papers of this kind are presented at each meeting for their educational value and Dr. Swim was complimented on the practical way in which he presented his subject.

Attention was directed to the fact that in all probability the new Governor would make a change in the office of Commissioner of Agriculture. A motion prevailed that a letter be written Governor Green, calling his attention not only to the desirability but to the necessity for appointing a man who was committed to the policy of tuberculosis eradication now in progress throughout a large part of the State.

Dr. George W. Rawson, of Parke, Davis and Company, read an interesting paper, entitled, "The Screw-Worm Fly," in which he related his experiences with this insect pest while in the southwestern states, several years ago.

Dr. Hugo Cornehl, chief veterinarian of the Department of Health, spoke on the subject of a new salary schedule for veterinarians of the Department engaged in meat inspection. This schedule is a marked improvement over the old one and a motion was made, seconded and duly carried, instructing the Secretary to write a letter to Commissioner Vaughan thanking him for his interest and action in the matter.

H. Preston Hoskins, *Secretary*.

NECROLOGY

WILLIAM G. MELCHIORSEN

Dr. William G. Melchiorsen, of Omaha, Nebraska, died October 19, 1926, following an operation for gall-stones.

Born in Omaha, August 14, 1884, Dr. Melchiorsen remained in his native city until 1913, when he moved to Washington, D. C., and entered the United States College of Veterinary Surgeons. He was graduated in 1917. During the World War he served as Post Veterinarian at Fort Snelling, Minn., and later he was stationed at Camp Grant with the 331st Field Artillery. When this unit was sent to France, Lt. Melchiorsen was assigned to duty in Chicago to look after army contracts. Later, he was stationed in Omaha and New York City. He held a commission as captain in the Officers' Reserve Corps.

At the time of his death Dr. Melchiorsen was chief veterinarian for the Western Weighing and Inspection Bureau at Omaha. He joined the A. V. M. A. in 1918 and was among those who attended the recent meeting in Lexington. He was an Odd Fellow, a Mason and a Shriner.

Dr. Melchiorsen is survived by his widow, two daughters, two sons, his father and one brother.

M. R. GRAINGER

Dr. M. R. Grainger, of South Lyon, Mich., died October 29, 1926. He was a graduate of the Ontario Veterinary College, class of 1887, and practiced at Plymouth, Mich., for over thirty years. He moved to South Lyon about two years ago and discontinued active practice, on account of failing health.

JOHN L. BORING

Dr. John Levi Boring died at his home in Acton, Indiana, November 30, 1926, aged 69 years. He was a registered non-graduate and had practiced in his community for almost fifty years. He was well thought of and had many friends in the locality he served.

ALFRED J. GREGG

Dr. Alfred J. Gregg, of Mt. Clemens, Mich., died December 26, 1926, of injuries received in an automobile accident the day before Christmas.

Born February 1, 1882, at Providence, R. I., Dr. Gregg was a graduate of Michigan State College, class of 1920. He practiced at Saline, Mich., for about three years following graduation and then removed to Mt. Clemens, purchasing the practice of Dr. J. J. Donohoe at that place. Dr. Gregg joined the A. V. M. A. in 1922. He was also a member of the Michigan State Veterinary Medical Association.

BOYD BALDWIN

Dr. Boyd Baldwin died at his home in Chicago, January 1, 1927, following an illness of several months.

Born in New York City, May 6, 1854, Dr. Baldwin moved to Illinois with his parents, at the age of 16, and lived on a farm near Ellisville, until his graduation from the Chicago Veterinary College, in 1892. He practiced at Abingdon and Galesburg, Ill. In 1897 he entered the employ of the Bureau of Animal Industry. He retired in 1924, upon reaching the age of 70.

Dr. Baldwin joined the A. V. M. A. in 1916. He enjoyed good health until a short time before his death. He is suvived by his widow, four daughters and one son. Funeral services were held at Avon, Ill.

LUTHER E. OLSON

Dr. Luther E. Olson, of Avon, Ill., took his own life, January 5, 1927. His body was found hanging in a shed. Ill health was attributed as the cause. Dr. Olson was a graduate of the Kansas City Veterinary College, class of 1911. For a number of years he was a veterinary inspector in the employ of the Bureau of Animal Industry and was stationed at South St. Paul, later at Indianapolis, and again at St. Paul. He joined the A. V. M. A. in 1913. Dr. Olson is survived by his widow, one daughter, his mother and four brothers.

PERSONALS

MARRIAGE

Dr. F. H. Gordon to Miss Bertha Anderson, both of Mountain Grove, Mo., December 16, 1926.

BIRTHS

To Dr. and Mrs. F. O. Slagle, of Lewiston, Nebr., a daughter, Vera Mae, November 6, 1926.

To Dr. and Mrs. R. W. Williams, of Eldorado, Ark., a daughter, Jo Ellen, November 6, 1926.

To Dr. and Mrs. J. O. Carlson, of Granite Falls, Minn., a daughter, Corinne, November 8, 1926.

To Dr. and Mrs. M. J. Kennedy, of Missouri Valley, Iowa, a daughter, Patricia Eileen, November 25, 1926.

To Dr. and Mrs. C. L. Johnson, of Harvey, N. D., a son, Gerald Russell, November 30, 1926.

To Dr. and Mrs. W. S. O'Brien, of Ryan, Iowa, a son, William S., December, 11, 1926.

To Dr. and Mrs. H. W. Wilson, of Helena, Ark., a daughter, Mildred Louise, December 29, 1926.

PERSONALS

Dr. L. H. Conlin (Corn. '23), of South Lansing, N. Y., gives his new address as Vergennes, Vt.

Dr. O. K. Simonsen (Iowa '25), formerly of Storm Lake, Iowa, is now located at Cherokee, Iowa.

Dr. J. G. McKee (A. P. I. '26) has left West Lebanon, Ind., to accept a position in North Carolina.

Dr. F. R. Allerton (K. S. A. C. '25), formerly located at Hamlin, Kans., has moved to Morrill, Kans.

Dr. Thomas Carlisle (U. P. '01), of Chestnut Hill, Pa., was operated upon for appendicitis early in January.

Dr. W. C. Outhier (San Fran. '04), of Yuma, Ariz., has removed to Anaheim, Calif. Address: 217 No. Olive St.

Dr. F. C. Grenside (Ont. '79), of Guelph, Ont., has been appointed a member of the Parole Board of the Province of Ontario.

Dr. Louis P. Cook (O. S. U. '95), formerly dean of the Cincinnati Veterinary College, is now City Veterinarian of Cincinnati.

Dr. W. A. Wallace (Cin. '20), of Ashland, Ky., is Boyd County veterinarian, in addition to conducting a large general practice.

Dr. A. J. Erickson (Chi. '11), formerly located at Donovan, Ill., has removed to Tuscola, Ill. He is Douglas County Veterinarian.

Dr. F. H. Zimmerman (McK. '11), of Havana, Ill., has been engaged as Effingham County Veterinarian by the Board of Supervisors.

Dr. Edward A. Cahill (U. P. '09), vice-president of Pitman-Moore Company, of Indianapolis, sailed for Europe about the middle of January.

Dr. Frank V. Matthews (Chi. '06) has returned from a long sojourn in Florida and resumed active practice at his home, McKeesport, Pa.

Dr. T. B. Carter (Ont. '14), who has been located at Tillamook, Ore., for about a year, is back in Portland. Address: 709 East 29th St. N.

Dr. O. A. Meyer (Chi. '11), of Alton, Ill., recently completed a veterinary hospital, especially equipped for handling canine and feline patients.

Dr. R. L. Pontius (Ont. '08), of Lexington, Ky., recently negotiated the purchase of a home, costing $12,000, on Slashes Road, Ashland Park.

Dr. George L. Nicholas (U. P. '02), formerly of Yerington, Nevada, has entered general practice at Roseburg, Oregon. Address: 725 West Lane.

Dr. Chas. W. Frush (O. S. U. '16), of Pittsburgh, Pa., was severely bitten by a rabid dog recently, and underwent the 15-day anti-rabic treatment.

Dr. C. J. Bryer (U. P. '23), who has been stationed at the Union Stock Yards, Lancaster, Pa., has removed to Gap, Pa., and entered practice there.

Dr. H. E. Rea (Ont. '02), of West Branch, Mich., has commenced construction of a new veterinary hospital to replace the one he lost by fire a few months ago.

Dr. Harry D. Clark, of Glenwood, Ind., recently opened a new veterinary hospital, fully equipped with waiting-room, office, pharmacy, operating-room, kennels and garage.

Dr. Eugene A. Rodier (Wash. '20), formerly of Pullman, Wash., is now located at the Veterinary Research Laboratory of the Bureau of Agriculture, Pandacan, Manila, P. I.

Dr. F. M. Gallivan (Ind. '14), of Oskaloosa, Iowa, became associated with the Globe Laboratories of Fort Worth, Texas, in the capacity of Laboratory Director, January 15, 1927.

Dr. F. L. Parse (Ind. '07), who has been practicing at Oxford, Ind., since last summer, has returned to Mississippi. He is located at Starkville, on tuberculosis eradication work.

Dr. C. L. Kern (Corn. '24), formerly of Atlanta, Ga., is now with the Dairymen's League Cooperative Association, as Division Veterinarian, with headquarters at Middletown, N. Y.

Dr. James T. Glennon (N. Y. C. V. S. '96), of Newark, N. J., has been taking the special course in diseases of small animals at the University of Pennsylvania School of Veterinary Medicine.

Dr. H. E. Ash (Ont. '15), of Bowling Green, Ohio, received rather extensive injuries in a collision between his Nash sedan and a New York Central freight train, about the middle of December.

Dr. Edgar W. Culley (Ont. '96), of Paris, Tenn., was chosen president pro tem of the council recently. He simultaneously became mayor of Paris, following the resignation of Mayor Arnett.

Dr. L. E. Webster (Ind. '13) recently returned to Effingham, Ill., after spending a year in France. He held a commission as lieutenant in the 157th Field Artillery Brigade of the 82nd Division.

Dr. J. H. Rietz (O. S. U. '03), who has been pursuing postgraduate studies at the Ohio State University the past year, has taken up his new duties at the University of West Virginia, at Morgantown.

Dr. William H. Haskell (U. P. '12), who has held the position of Dairy and Meat Inspector of Beaumont, Texas, for a number of years, has resigned to accept a position with U. S. Public Health Service.

Dr. R. H. Bardwell (Corn. '26) has given up his work with Dr. M. M. Leonard, at Asheville, N. C., and has returned to Ithaca, to carry on the work of Dr. M. G. Fincher, while the latter is on a leave of absence.

Dr. M. G. Fincher (Corn. '20), of Cornell University, has been granted a leave of absence for a year, in order that he may conduct some research work for a number of horse-breeders in the vicinity of Lexington, Ky.

Dr. H. L. Van Volkenberg (Corn. '18), who has been with the Bureau of Biological Survey of the United States Department of Agriculture for some time, is now stationed at the Agricultural Experiment Station, Mayaguez, Porto, Rico.

Dr. Benjamin McInnes (R. C. V. S. '74), of Charleston, S. C., visited his daughter, wife of Dr. Emlen Wood (U. P. '16), at Greenwich, N. J., during January and attended the University of Pennsylvania Veterinary Conference on the 4th and 5th.

Dr. C. C. Yule (Ont. '93), of Bellefontaine, Ohio, and Dr. J. F. Stevens (O. S. U. '97), of West Liberty, Ohio, were injured in an automobile accident near Urbana, Ohio, in December. The car in which they were riding skidded on a slippery road and turned completely over, landing in a ditch.

Dr. F. A. Walters (McK. '16), of Lemont, Ill., lost his Ford coupe by fire, the early part of December. The car skidded on a slippery hill and turned over into a ditch. The car was righted and Dr. Walters started back toward town. Coming into Lemont the car became uncomfortably warm. Investigation revealed the bottom of the car in flames. It was entirely consumed.

Dr. Joseph A. Coad (Ont. '23), of Hamilton, Ont., accompanied by his wife, a recent graduate of the Medical Department, University of Toronto, are touring the United States, inspecting small-animal hospitals in the large cities. They spent a day in Pittsburgh, in December, and were accompanied by Dr. James A. Waugh in visiting the six veterinary hospitals in the Smoky City.

Dr. Robert Prior (Wash. '12), of Olympia, Wash., represented the governor of the state of Washington at the formal dedication of David S. Troy Hall, dairy manufactures building at the State College of Washington. The new building cost about $200,000 and the ceremonies, at which Dr. Prior formally presented the building to a representative of the Board of Regents of the College, took place on December 10, at Pullman.